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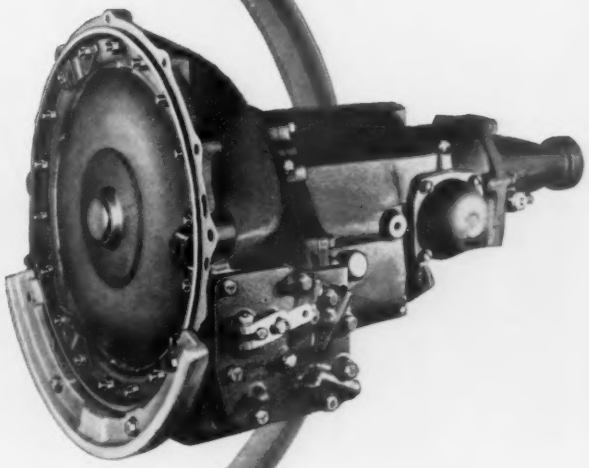

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Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

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NEWS CORRESPONDENTS

CARL S. HOGLUND
5107 Telegraph Road
Los Angeles 22, Calif.
Phone: Angelus 1-8136.

PHIL GLANZER
223 Coldstream Avenue
Toronto 12, Ont., Canada
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*Appears every other month

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Highlights Sidelights *of the News . . .*

January, 1958

DuPont has been granted a United States Patent on the manufacture of linear polyethylene thus becoming, in the company's words, "the only company entitled to license" the manufacture of the plastic . . . The company has notified other producers of linear polyethylene that it is now prepared to offer manufacturing licenses . . . Some producers of this type of polyethylene dispute DuPont's claim in this field and it seems likely that court battles may be in the offing (page 692).

Chemische Werke Huels is now constructing a synthetic rubber plant at Marl, Germany, with the assistance of the Firestone Tire & Rubber Co. . . . Firestone is providing help in the construction of some units . . . It is reported that the American and the German companies have reached agreement on the matter of licenses and an "exchange of experience" . . . To be in service by mid-1958, the plant will produce 45,000 long tons of styrene rubber annually (page 693).

General Tire has completed an agreement with the Moroccan Government which gives the American company certain privileges toward the production of tires in that country . . . The agreement is said to involve more than $7 million . . . The Moroccan Government has agreed that no other company will have the right to manufacture tires in that country for a period of five years and that General Tire has the right to import, duty-free, equipment for setting up a tire factory (page 701).

U. S. Rubber has consolidated the activities of the New York Belting & Packing Co. into the parent organization in a move to strengthen the company's nationwide network of industrial rubber products distributors . . . All of New York Belting's products will now be sold under U. S. Rubber brand names . . . New York Belting was one of the nation's oldest industrial rubber goods manufacturers, having been organized in 1846 (page 709).

Meetings of interest reported on in this issue: The two-day meeting of the Rubber and Plastics Division of the American Society of Mechanical Engineers in New York City and the two-day meeting of the Southern Rubber Group in Memphis, Tenn. . . . The ASME meeting (page 694) featured four technical sessions, while the Southern Group meeting (page 696) was highlighted by panel discussions on quality control and adhesives and bonding.

DON'T MISS

The annual "Review and Preview" of the rubber industry for the years 1957-58 which appears beginning on page 641 of this issue!

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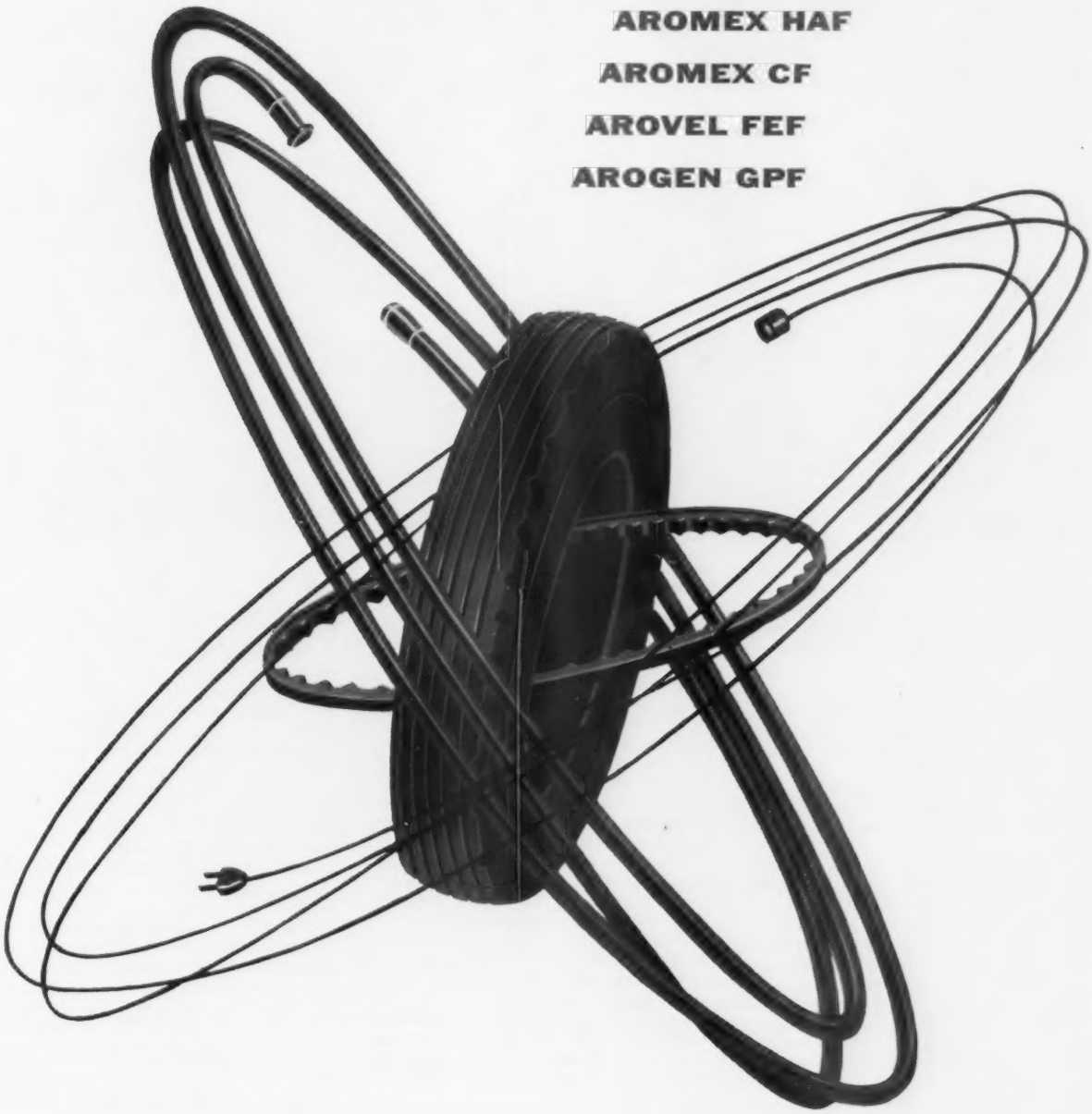

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Letters to the editor

The October, 1957, issue of RUBBER AGE carried an editorial commenting upon the system of nomenclature for synthetic elastomers proposed by Committee D-11 on Rubber and Rubberlike Materials of the American Society for Testing Materials. It is our position that the proposed system, far from hitting the mark, may tend to completely confuse the literature. The letters which follow express individual reader's sentiments on this question—**Editor.**

Dear Sir:

In your editorial in the October, 1957, RUBBER AGE, you say that it is time to call a halt to efforts to establish a uniform system of nomenclature for elastomers. On the other hand I think that now is the time to adopt such a system and that the longer it is put off the more chaotic the situation will become. Perhaps the proposed ASTM system is not the answer but I think your arguments against it are pretty weak.

The term GR-S has been accepted on a world-wide basis both as a name and as an abbreviation. It was decided to abandon the term about two years ago. In addition to this vacuum in terminology we were faced with an increasing number of elastomers of varying compositions. Various names and abbreviations started coming into use with no coordination. Already there are indications of the use of two or more terms for the same material and of the same term for two or more different materials. The sooner some standard nomenclature is adopted the less this confusion will grow.

It is my opinion that now is the time to establish a rational system of nomenclature which can be applied to all current synthetic rubbers and expanded to fit future rubbers into the same system. It should be applicable to government specifications and scientific publications where trade names are not permissible. It should be capable of international use by covering products from many producers in many countries. It should describe the products as precisely as possible in limited terms. It should provide names to use when they are needed and abbreviations or codes to use where condensed terminology is needed and can be understood. The ASTM proposal makes a good start towards meeting these requirements.

There are at least two good reasons why the terms "butyl" and "neoprene" are not suitable for use in an over-all scheme, although the original producers have made them common names and have not promoted them as trade names. The first is that they were coined independently and have no tie-in with each other or with any other trade, chemical, or common name. The second is that they are designed to cover families of polymers. Neoprene covers polymers of chloroprene and also its copolymers with various other monomers. Butyl has been used for polymers of isobutylene with both butadiene and isoprene. Would the producers of neoprene and butyl agree to a restriction of their use sufficient for them to meet the requirements of classification by composition?

Your first objection to the proposed ASTM system is based on a misuse of it. You start with a series of abbreviations and ask how many readers can tell what you are talking about, especially when the abbreviations are not used properly. If you started out referring to Isoprene Rubbers (IR), Styrene-isoprene rubbers (SIR), Nitrile-chloroprene rubbers (NCR), etc., and subsequently used only the abbreviations, the meaning would be clear. This is the normal practice where new or possibly unfamiliar abbreviations are used and is adequately provided for in the designations so far accepted. It is exactly the procedure you used when you spoke once of the American Society for Testing Materials and subsequently referred to it as A.S.T.M. It is also the procedure used on page 97 for PEG400 and PPG1025. On page 92 it is assumed that the reader will be familiar with the abbreviations EPC, DOTG and MH3. This is probably true with readers of the RUBBER AGE. However, many readers of *Industrial and Engineering Chemistry* would not know just what they meant without some sort of code book. If the ASTM system were used properly, your readers would not have been confused.

Who would recognize "rany" if they met it in an editorial without an introduction?

You doubt the value of any code because of the necessity of using abbreviations or letter combinations. Many of your advertisers do not agree. Without trying to finish your price list of the same month I counted over 60 products identified by abbreviations or by combinations of letters and as many more identified by combinations of letters and numbers. There are many other abbreviations which are widely used in the industry.

You are afraid the code books will have to be used by rubber chemists in reading technical articles and reports. If technical writers follow the practice of using abbreviations without explanation they will obviously be unintelligible until the abbreviations are explained from a code book or otherwise. In that same issue of the RUBBER AGE there are many abbreviations used which are intelligible only because they are explained right there. There are a few which are not explained but are intelligible to an experienced rubber chemist because he remembers the code.

In the course of his daily activity a rubber chemist already has to keep a variety of catalogues and code books handy. He may remember what many of them say, but periodically he has to refresh his memory or check a new material.

For various reasons a number of rubber companies code all raw materials by combinations of letters, numbers, or trick names. All compounds are written in code with the help of code books.

All of the synthetic rubbers given in your price list are really identified by codes which are combinations of letters, numbers, or both. Broad types are indicated by general names. These general names, however, are not sufficiently precise for compounding use (especially the Butadiene Styrene Type which contains no styrene). The names butyl and neoprene give no indication of composition. The trade names give no indication of how the products differ among themselves or of which products from different suppliers are comparable. This vital compounding information is covered by letter combinations or numbers and is given in the suppliers catalogues which to this extent are code books. Each compounder remembers what the books say about those materials he uses frequently. However, I doubt if you have ten readers who can identify all the rubbers in your price list well enough to repeat an experiment without reference to at least four code books.

ASTM Designation D735 is a complicated code for automotive rubber which is used very extensively.

About 15 years ago the carbon black people adopted a code of names and abbreviations for blacks. It has worked well and is almost universally accepted. As an illustration of its use compare your price list of 1940 which contained 20 blacks listed by trade name in alphabetical order with that of 1957 which contains 109 blacks classified by industry standards. Ask any working compounder which is better.

It seems to me that the evidence is all in favor of codes and code books even when they use abbreviations or letter combinations.

The nomenclature and coding are complicated and will become more so. The only way to avoid this complication is to stop making new polymers and to discard many that are already made. A large number of products of various compositions cannot be described precisely in a few simple terms. To a con-

(Continued on page 574)

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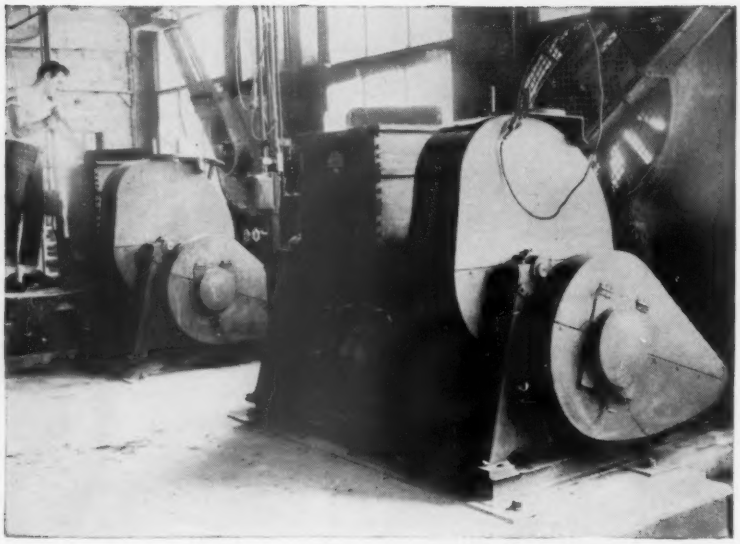

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siderable extent the complication is dependent on the precision required. The ASTM proposal makes a good start by showing the monomers in the polymer. Additional coding (or long descriptions) are needed for compounding and use. At present there are at least twelve systems used for this more precise definition. Without the current attempts at standardization this number could jump to 24 overnight.

To summarize, I think we need a rational system of nomenclature for elastomers now. The ASTM recommendation is the best proposal yet made. In form and content it is well in line with industry practice.

Rather than do nothing, have you anything to propose?

B. S. GARVEY, JR.
Pennsalt Chemicals Mfg. Co.,
Wayne, Penna.

Dear Sir:

ASTM D 1418-56T establishes a system of classification for rubbers and related polymers. It is not intended to name or rename rubbers on the market although it may appear to do so, since it established the code SBR to replace the obsolete code GR-S. It is agreed that the full name of the rubber or polymer is preferable in a technical article. However, there is bound to be a short-hand or code system used. I think you will agree that when a code system is used it should be part of a generally accepted system rather than current practice where each manufacturer develops his own code without rhyme or reason. ASTM D 1418-56T besides establishing a classification system gives a short-hand code for that system. The need for such a system and code can best be seen by considering past and present names for rubbers.

Private manufacturers have followed the same practices as the Government in using the same term for a variety of materials. For example, RFC used GR-S for polybutadiene, polyisoprene, styrene-butadiene copolymers, and styrene-isoprene copolymers. DuPont used neoprene for polychloroprene and copolymers of chloroprene with isoprene, styrene or other monomers. Furthermore, rubbers like Hycar OR have been renamed by the manufacturer so that it is not possible without a code book to distinguish between a nitrile-butadiene rubber, a styrene-butadiene rubber, a brominated butyl rubber and an acrylate rubber.

These illustrations serve to show some of the confusion that has occured in the past when there were only a few manufacturers of synthetic rubber. The situation promises to be hopeless in a few years with some 20 manufacturers, unless a classification system is generally accepted and used. On page 169 of the October, 1957, issue of RUBBER AGE is a partial list of the rubbers commercially available today. Only in the case of some styrene-butadiene rubbers is there a readily available description of the numerous codes; namely, ASTM D 1419-56T and D 1420-56T. Few people are aware that some types of neoprene listed

(Continued on page 576)

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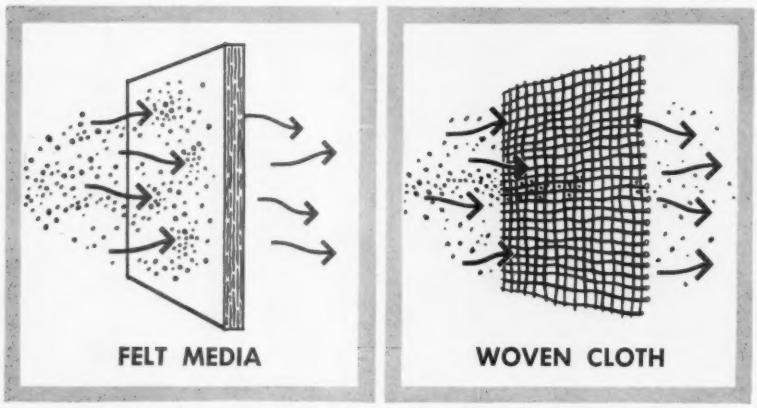

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EQUIPMENT ONLY OR A COMPLETE SYSTEM

are copolymers of chloroprene and other monomers. A different coding system is used for Enjay Butyl and Polysar Butyl. If this situation continues, a rubber technologist is bound to need a library of manufacturers' handbooks, trade mark registers, compendiums, etc., in order to be versatile. In my opinion, the problem has become acute because of the multiplicity of rubbers commercially produced at present and the large number of new rubbers under development. A system for classifying these rubbers appears to be the only solution to simplify the complex existing situation.

ASTM D 1418-56T can serve a very useful purpose if generally adopted. Polysar Krynac and Polysar Krynol could be designated Polysar NBR and Polysar SBR followed by numbers to represent specific polymers. Similarly, the Hycar rubbers could be designated Hycar NBR, Hycar SBR, Hycar IIR, etc. We would have Philprene SBR, and Philprene PBR. Thus, ASTM D 1418-56T supplemented by number codes such as D 1419-56T provides a means of avoiding chaos and making the life of the rubber chemist and technologist a little easier. He would have much less to learn than he does at present even though the number of rubbers increase manyfold.

It is to be expected that manufacturers will be reluctant to change current practice. For this reason, it is necessary to have organizations like ASTM and the trade journals emphasize the urgent need for a classification system and to show manufacturers the advantages of conforming to it. Probably five years or more are needed to achieve this objective. The RUBBER AGE might be an effective catalyst by adopting and using this classification and coding system.

NAME WITHHELD

Dear Sir:

I share your view that the code system outlined in the tentative ASTM recommendations for nomenclature for elastomers has failed to meet its objective and should be abandoned. I also agree with you in that there is actually no need for the new nomenclature since the internationally used designations 'nitrile rubber', 'butyl rubber' (or 'butene rubber'), 'neoprene', etc., are clear, precise and well established. The existing nomenclature is thus fully satisfactory.

I disagree with your statement that the designation 'GR-S' presents a problem and has to be replaced. There is no need for this either. I feel that private industry can do that much to pay tribute to the men who created GR-S in retaining the name which symbolizes that a number of people from competitive companies got together under government auspices and cooperated to produce a commodity, which to some extent helped win the war and created a new profitable private industry. Let's not tear down the monuments of the past, especially since there is nothing in the past history of GR-S of which to be ashamed.

F. S. ROSTLER

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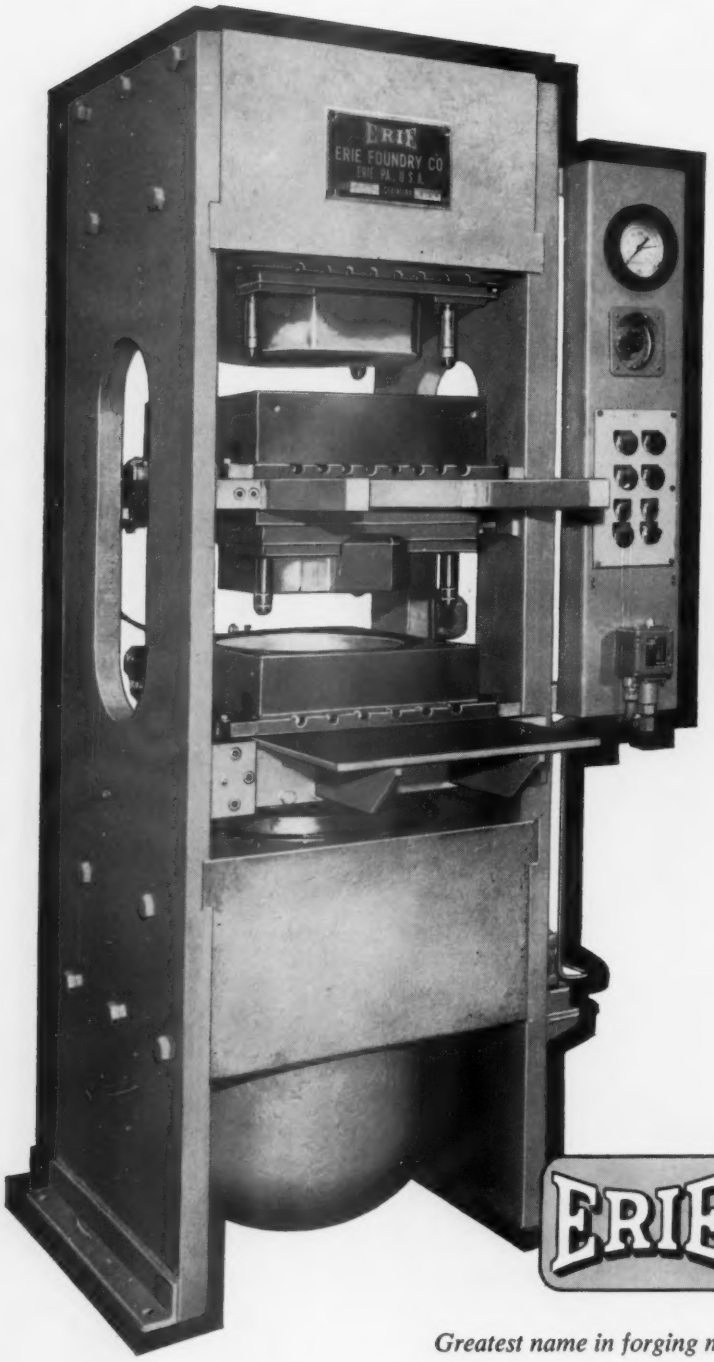

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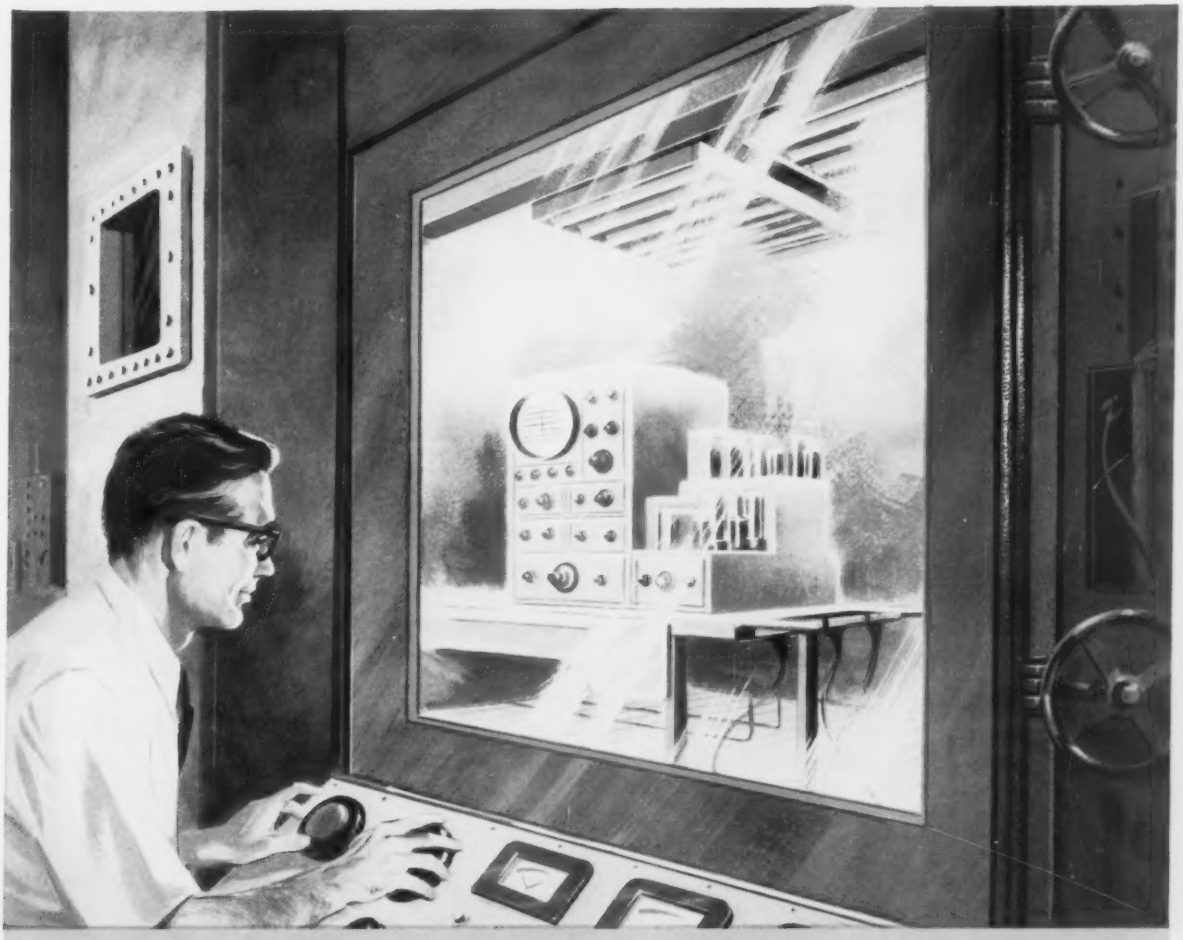

THE TEMPERATURE INSIDE IS 100° BELOW ZERO— YET ELASTOMERIC SEALANTS REMAIN AIR TIGHT!

Extreme test. The sealants used in this testing chamber, as well as the sealants used for the electrical equipment being tested, must withstand temperatures as low as minus 100 degrees. Under this severe cold, most ordinary sealants would crack or shrink away, causing leakage and failure.

No cracking, no harmful shrinking. Modern elastomeric sealants based on THIOKOL liquid polymers, however, are able to withstand intense cold without losing effectiveness. Despite temperature fluctuations, they remain efficient and adhere tenaciously – without cracking or becoming brittle. Not only do these modern sealants stand up under temperature extremes, but they are also highly resistant to water, gas, air, vibration, and many chemicals. These sealants give exceptionally long life . . . eliminating the need for frequent resealing.

Thiokol®
CHEMICAL CORPORATION

® Registered Trademark of the Thiokol Chemical Corp., for its liquid polymers, rocket propellants, plasticizers and other chemical products.

Commercial refrigeration. New elastomeric sealants are proving especially valuable in the refrigeration industry, where they are used to seal flooring, door jambs and other critical joints in all types of refrigeration storage. If you are faced with the problem of finding a sealant to withstand extreme cold and other hazards, we invite you to investigate modern sealants based on THIOKOL liquid polymers.

FOR MORE INFORMATION, mail coupon to Dept. IIs Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton, N. J. In Canada, address Naugatuck Chemicals Division, Dominion Rubber Co., Elmira, Ontario.

Gentlemen: Please send me further details about modern elastomeric sealants based on Thiokol liquid polymers.

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City_____ State_____

Your Name_____

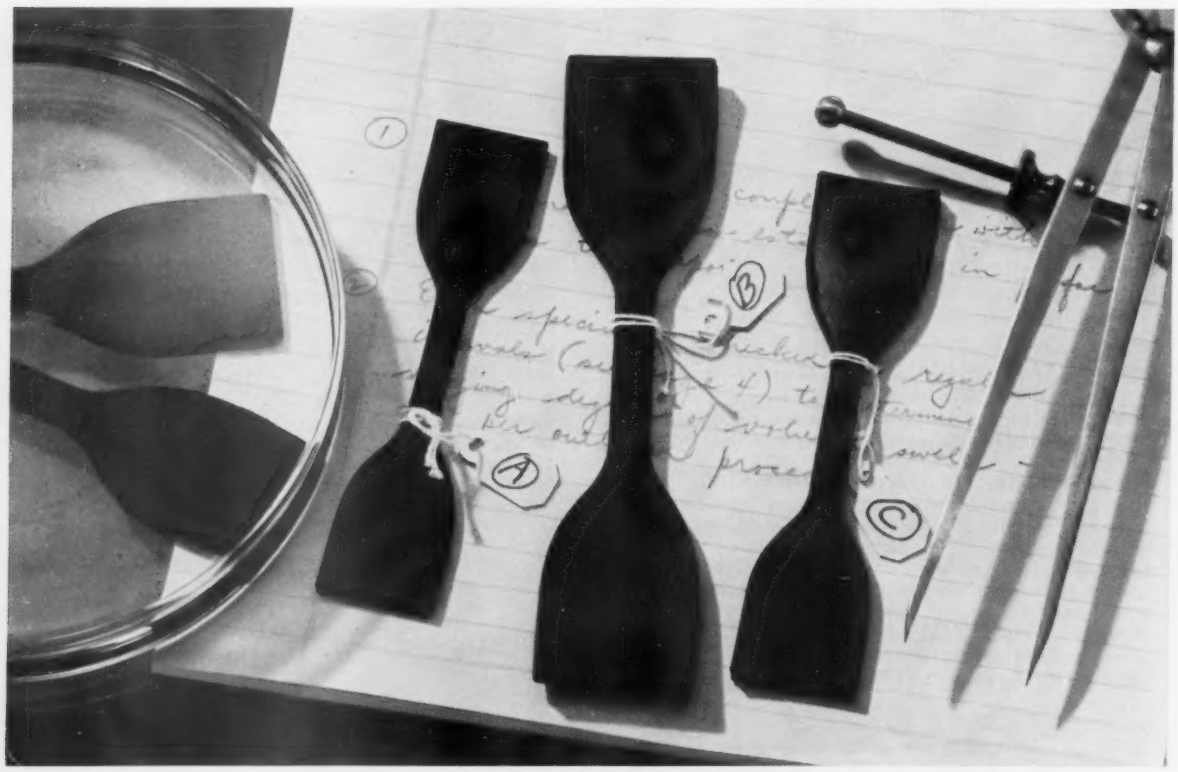
Plasticizers vs. Solvents

Synthetic rubber has long been a battleground where plasticizers and solvents wage a war of chemical action and reaction. Too often the plasticizers have lost. Now, with non-leachable Turpol® NC-1200, 3M has turned the tide.

Under solvent attack, plasticized rubber often loses its flexibility. The rule and the reason: most plasticizers are extracted by solvents. An exception: Turpol NC-1200.

Turpol's advantages . . . A soft, rubbery polymer, Turpol NC-1200 is synthesized to resist leaching out —even under prolonged exposure. And, unlike ordinary plasticizers, Turpol will maintain the desired flexibility without affecting the strength or solvent resistance of the base rubber itself.

An additional advantage found in Turpol-softened rubber is that the degree of swelling that results after



Volume swell in Turpol-softened rubber is demonstrated by immersion in toluene. After soaking for equal lengths of time, identically sized billets show that the formulation containing **Turpol** (left) swells far less than that plasticized with vulcanized vegetable oils (center), and no more than the unplasticized billet.

solvent contact is held at a minimum—no more, in fact, than that of non-plasticized formulations.

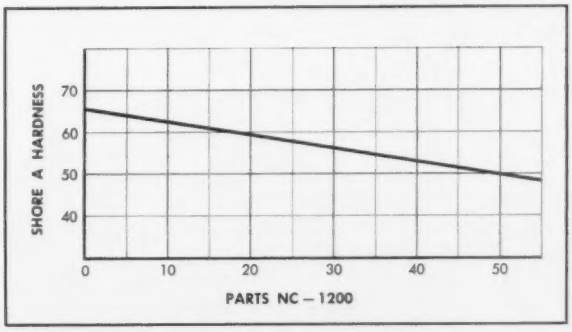
Proved in the lab . . . Laboratory tests have proved Turpol far superior to such softening agents as vulcanized vegetable oils. For example: these flexibilizing oils leach out readily, returning the base rubber to relative hardness, and actually reduce its strength. What's more, solvent-caused swelling is considerably greater than that which occurs in rubber flexibilized with Turpol.

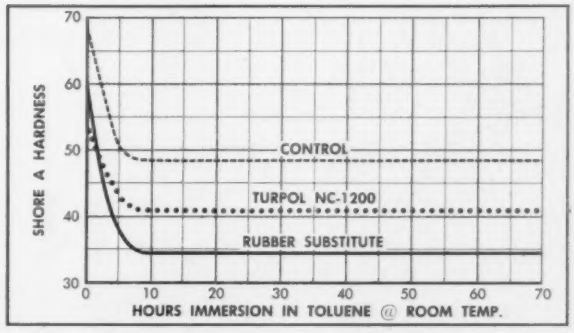
And in the field... Turpol is already being used successfully to increase the service life of printing rolls and blankets, gas and oil hose and tanks, gaskets, tank lining materials, diaphragm cloth, rubber gloves.

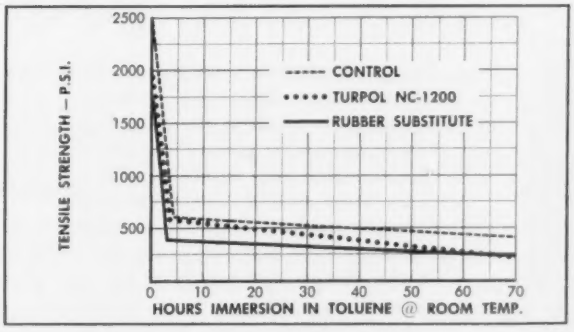
Available for your use in slabs, Turpol is milled into base rubber with standard equipment. It is particularly applicable in compounding low durometer stocks, and is compatible with most synthetic plastics used in rubber formulations.

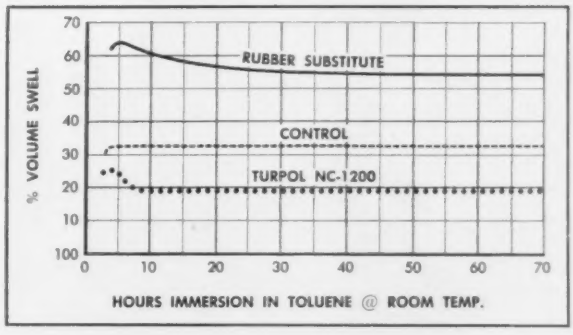
For complete data on non-leachable Turpol NC-1200 —applications and formulations—fill out and mail the coupon below.

How Turpol NC-1200 affects hardness, tensile strength, and volume swell









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Please send latest data on non-leachable Turpol NC-1200.

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Trust is warranted in **Picco Resins**. Carefully manufactured in large quantities, **Picco Resins** assure uniformity and high quality.

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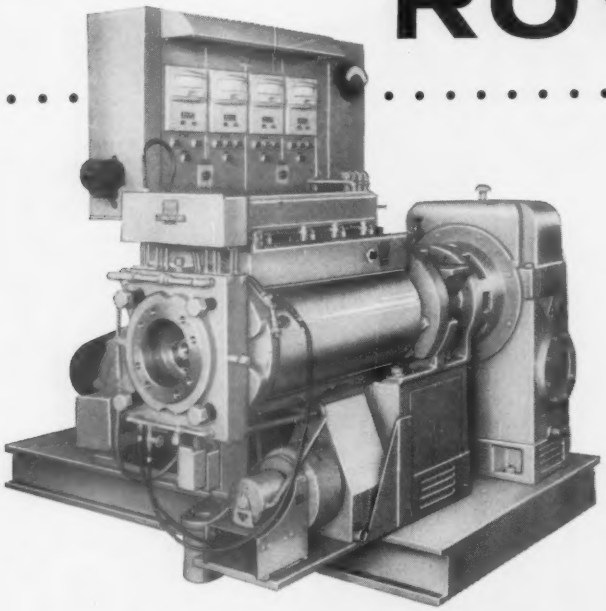
ROYLE



SPIROD® EXTRUDERS

These all electric extruders with radiant heat and high velocity evaporative cooling are designed to process either plastic or rubber compounds. The result of more than three quarters of a century of experience — Royle pioneered the extrusion process in 1880— in the design and construction of extruding machines time tested features have been built into Spirod to assure dependability.

Write for Bulletin #463

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

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Photo courtesy Wilson Sporting Goods Co., Chicago, Illinois, and Haartz-Mason, Inc., Watertown, Mass.

It gives them a true "kick"—weather or not!

It used to be that low cost footballs couldn't match the spirit of their young users. When the going got wet, they would go out of round and lose their stability in the air. They also would lose their pebble embossing and become hard to handle.

What was needed was a new kind of cover. This took some doing but finally a leading fabric coater came up with a successful solution—a thick, heavy-duty coating based on PLIOFLEX rubber. Result: A tough, long-wearing cover that withstands the wettest weather, without losing its shape or embossing.

The major reasons for using PLIOFLEX in these covers are: First, its permanently light color permits bright, clean colors without the expense of natural rubber. And second, its high uniformity makes possible a product of consistently high quality.

Perhaps PLIOFLEX can give you a truer performing product. For the full story, including complete technical assistance, on PLIOFLEX and other raw materials for the rubber industry, write to

Goodyear, Chemical Division, Dept. M-9418,
Akron 16, Ohio.

CHEMIGUM
PLIOFLEX
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High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

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RUBBER &
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DEPARTMENT

Chemigum, Plioflex, Pliolite, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Photo courtesy Cameron Iron Works, Inc., Houston, Texas, and Linear, Inc., Philadelphia, Pa.–Manufacturers of Precision Molded Seals

How to make 4 lbs. of rubber pack a 1000-ton load

To batter a billet into rough shape, prior to machining, is no chore for the hydraulic forging press shown above. A press of a button and it works down the hot steel with a thousand tons of pressure every several seconds.

But it was a chore to find an adequate seal for the big press ram. Its designers looked long and hard before they found a split ring packing that would not leak under the high pressure and fast traverse.

Twin secret of the success of the fabric-reinforced, precision-molded, rubber rings now used are their unique design–and CHEMIGUM. A series of internal, V-shaped dams and external abutments seal off any labyrinth leakage, while the CHEMIGUM assures a lastingly tight fit.

The reasons why the ring manufacturer uses CHEMIGUM for this and other precision seals are its excellent resistance to oil, heat and abrasion and its unusual ease of processing. How can this outstanding combination of properties benefit your product? For details, write to Goodyear, Chemical Division, Dept. M-9418, Akron 16, Ohio.

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Chemigum, Plioflex, Pliolite, Pliovic–T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

It's won fame in foam

Its name is WING-STAY S. It's a liquid styrenated phenol. And it's the leading choice of foamed goods manufacturers for a non-discoloring, nonstaining antioxidant.

WING-STAY S won its fame in foam for these good reasons: 1. It is easily emulsified and incorporated in latex 2. It is not extracted by water 3. It is nonvolatile, even when large surface areas are involved 4. It is nondiscoloring 5. It provides good all-round protection 6. It is low in cost.

If you want protection from heat, sunlight or age that will bring fame to your products—foamed or solid—get the full story on WING-STAY S. Samples plus the latest *Tech Book Bulletins* are yours by writing to: Goodyear, Chemical Division, Akron 16, Ohio.

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The Midland Steel Products Company
+ J. O. Ross Engineering Corporation

MIDLAND-ROSS CORPORATION

This Significant Merger involves No Lessening of Pre-Merger Services

Recently, the stockholders of Midland Steel Products and of Ross Engineering voted approval of the merger of the two companies as proposed by their respective directors. The new corporation is Midland-Ross Corporation. Often mergers change things, but in this case, there is no lessening of or deviation from pre-merger service. In fact, with the combined engineering, research and development skills, there will actually be a broadening of service.

Ross Engineers . . . the same Ross Engineers you know . . . will continue to work on problems involving 'Engineered Atmospheres' as they relate to drying, baking, curing, converting, heat-treating and similar operations. The Ross Service will be as comprehensive as before. . . experienced specialized engineering, modern manufacturing facilities . . . all in the field of Engineered Atmospheres.

The same service policy applies to the subsidiaries or affiliates listed in the shield shown below. The only change in the entire family of Ross Complementing Services is that J. O. Ross Engineering is now a division of the new corporation. Ross Service will continue as if nothing corporate-wise has taken place.

THE ROSS GROUP
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J. O. Ross Engineering, New York
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Ross Engineering of Canada Limited, Montreal
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Carrier-Ross Engineering Company, Ltd., England
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Why TY•PLY®

in Sikorsky helicopter rotor couplings . . .?

TY-PLY "BN"
for bonding N-types.

TY-PLY "UP-BC"
two-coat Adhesive System for bonding of Butyl Rubbers.

TY-PLY "UP-RC"
two-coat Adhesive System for bonding Natural Rubber and GR-S Compounds.

TY-PLY "Q" or "3640"
the single coat Adhesive for bonding Natural and GR-S Compounds.

TY-PLY "S"
for bonding Neoprene.

The M B Manufacturing Company specified TY-PLY BN for their Helicopter Rotor Coupling production because TY-PLY Rubber-to-Metal Adhesion Lasts A Lifetime!

TY-PLY is recommended for the severest of static, dynamic and chemical resistance requirements . . . the ideal choice of vulcanized bonding of rubbers to metals under varying process conditions. TY-PLY may be used for the widest variety of rubber-bonded units because TY-PLY defies all shear . . . tension . . . and compression forces.

TY-PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface.

get the facts . . .

Write Today for
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Division of BORG-WARNER
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TY-PLY has stood the test of time . . . since '39

HIGH RATIO RETURNS—This giant portable gang saw is one of many used deep in the nation's forests for on-the-spot lumber operations. Manufactured by Gunderson Bros. Engineering Corp. of Portland, Oregon, the saw presented a special power transmission problem. Normally, the 7 to 1 speed ratio at which the saw had to operate would have required a heavy and cumbersome double-reduction belt drive with jack shaft. Gunderson Bros. solved this problem by utilizing a unique, multi-ribbed Poly-V® Belt, manufactured by Raybestos-Manhattan, Inc., Passaic, New Jersey. The unusual strength and traction of this specially designed belt permitted the necessary speed ratio with but a single drive and single belt. This compact drive unit not only reduced the overall weight of the machine, thus adding to its portability, but minimized vibration as well. In order to provide the great lateral strength, crack-resistance and body required in Poly-V® Belts, Raybestos-Manhattan uses Mount Vernon top cover fabrics.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

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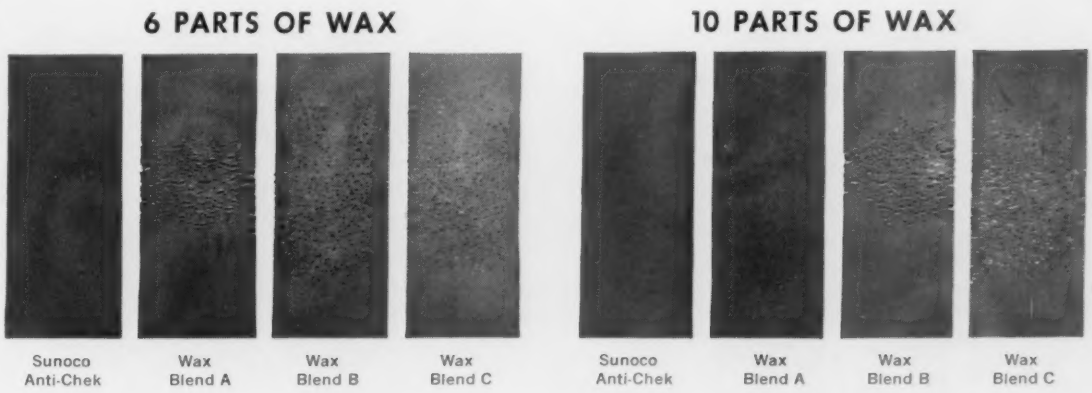

YOU NEED LESS SUNOCO ANTI-CHEK. Rubber test samples above show that it takes less Sunoco Anti-Chek to give your finished rubber products prolonged protection against checking and cracking. *Pound-for-pound, Sunoco Anti-Chek has proved best.*

You get better resistance to aging with less Sunoco Anti-Chek Wax

The controlled blooming rate of Sunoco Anti-Chek® gives *predictable* long-life weather-protection to your finished rubber products. Unlike ordinary waxes, that bloom too fast to last, Anti-Chek blooms at the optimum rate for longest service life. Result: You need *less* Sunoco Anti-Chek to get *better* resistance to sunlight, ultraviolet light, and ozone than ordinary waxes can provide.

Consistent quality and bloom rate from batch to batch of Anti-Chek are assured through the controlled refining process that *only* Sun waxes are put through.

Learn all the advantages of using Sunoco Anti-Chek. Ask your Sun representative or write for Technical Bulletin 30, SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RA-1.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

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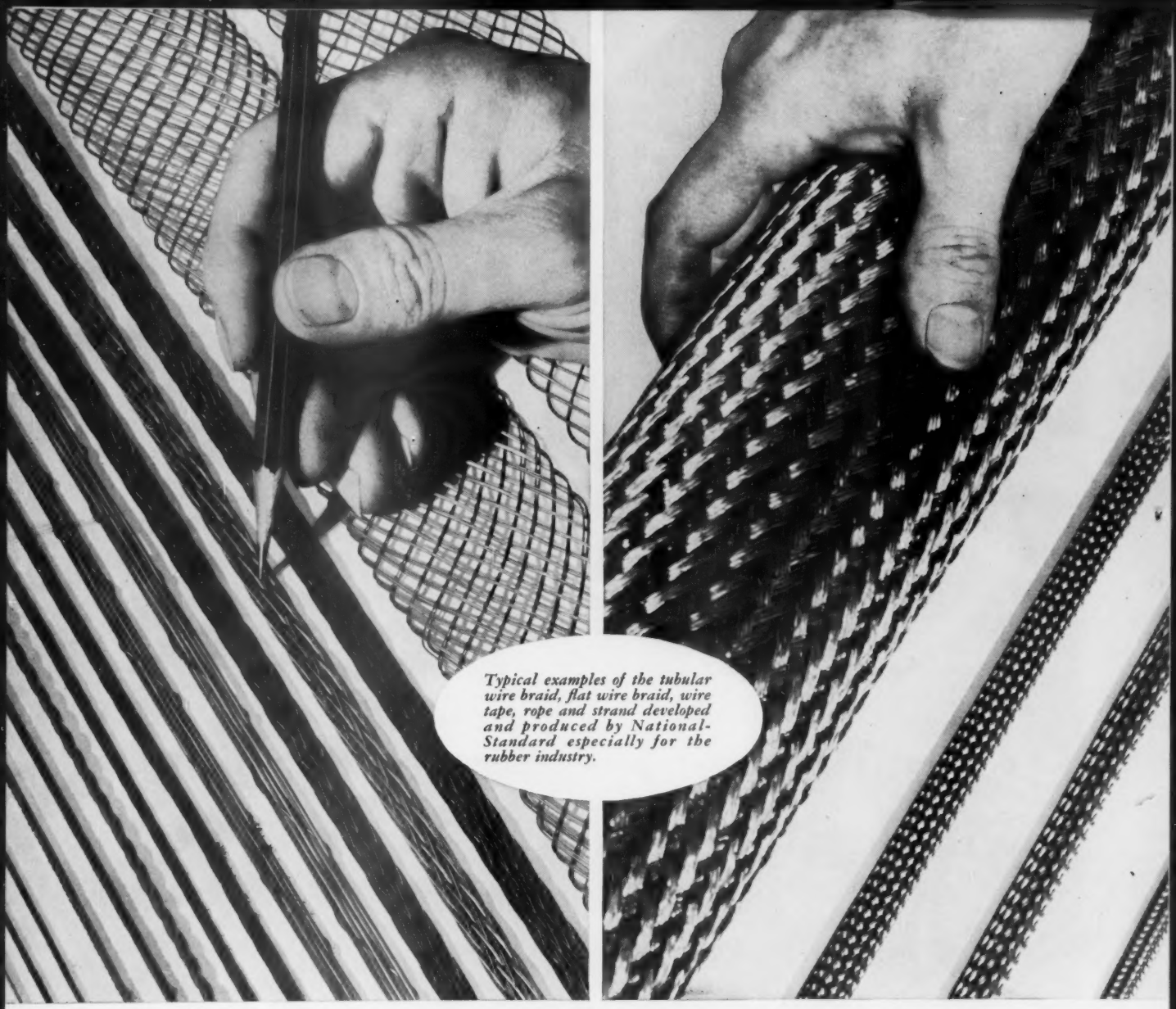


Typical examples of the tubular wire braid, flat wire braid, wire tape, rope and strand developed and produced by National-Standard especially for the rubber industry.

Wherever wire and rubber work together...

• For half a century, National-Standard has dedicated large scale research and engineering to improving the teamwork of wire and rubber. It is still going on . . . extensive work on wire fabrication, finish, corrosion, strength, elongation, adhesion and other factors that can affect the behavior and cost of your wire-in-rubber products.

So, wherever wire and rubber must work together, it is more than likely that National-Standard can contribute—particularly where new production or new service requirements are involved. We want to be of help . . . and are geared to do it well, without obligation. Check with us now . . . or anytime!

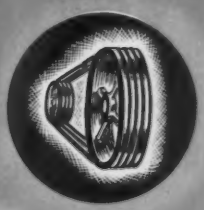
NATIONAL NS NATIONAL-STANDARD Company NILES, MICHIGAN **STANDARD**

DIVISIONS: NATIONAL-STANDARD, Niles, Mich.; *tire wire, stainless, music spring and plated wires* • **WORCESTER WIRE WORKS**, Worcester, Mass.; *high and low carbon specialty wires*
WAGNER LITHO MACHINERY, Secaucus, N. J.; *metal decorating equipment* • **ATHENIA STEEL**, Clifton, N. J.; *flat, high carbon spring steels* • **REYNOLDS WIRE**, Dixon, Ill.; *industrial wire cloth*

from Tires and Tubes
and Rubber Clothes
to Belts and Boots
and Garden Hose...

BETTER RUBBER PRODUCTS ARE MADE WITH CABOT VULCAN® AND STERLING®

THE INDUSTRY'S TOP QUALITY FURNACE CARBON BLACKS



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VULCAN 3	High Abrasion Furnace	(HAF)
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STERLING 99	Fine Furnace	(FF)
STERLING SO	Fast Extruding Furnace	(FEF)
STERLING V	General Purpose Furnace	(GPF)
STERLING L STERLING LL	High Modulus Furnace	(HMF)
STERLING S STERLING NS (NON-STAINING) STERLING R (FLUFFY)	Semi-Reinforcing Furnace	(SRF)
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GENERAL TIRE'S NEW
Synthetic Rubber – Carbon Black

provides up to 11%

Based on field tests of pilot plant material, tread wear results at 18,000 miles show Gentro-Jet outwearing dry-mix (HAF) by 11%. With Gentro-Jet you get a better product and save production time, too. See your General Tire Chemical Division representative now for complete information on Gentro-Jet test results.

Jet®

masterbatch

better tread wear!

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Creating Progress Through Chemistry

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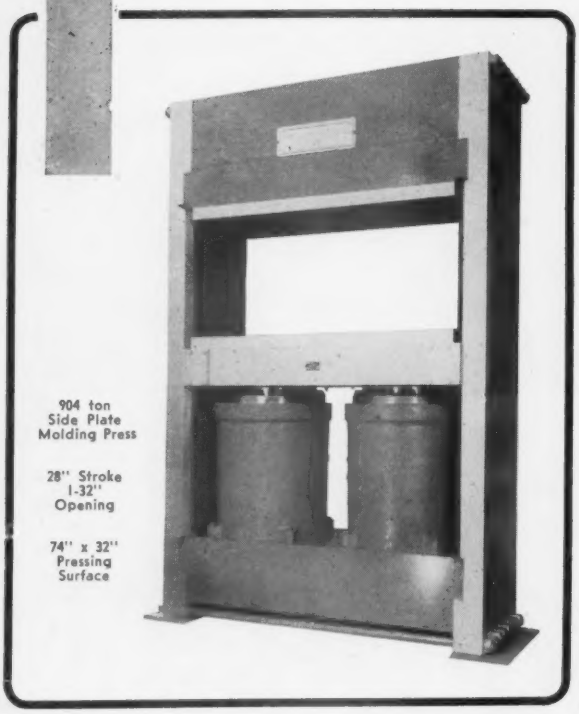

Shown above is one of the many different types of French hot plate molding presses specially designed for the rubber industry.

Available in all sizes to meet specific molding requirements, French presses are engineered to exact specifications and assure greater production efficiency with minimum scrap.

Take advantage of French's many years of specialized engineering experience — Investigate what French presses can mean in your molding operation. Write us today!

french

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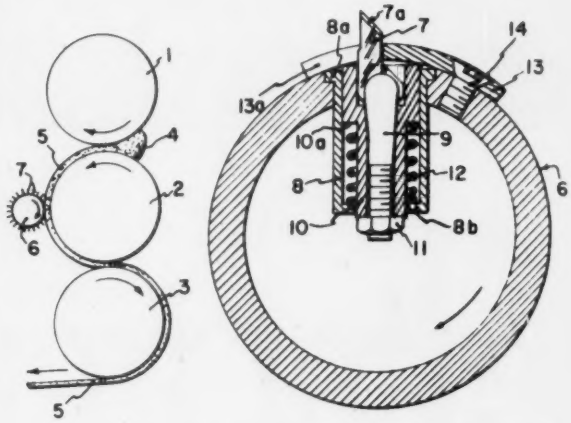
THE FRENCH OIL MILL MACHINERY CO.
1022 Greene St., Piqua, Ohio

PATENT REVIEW

by Melvin Nord

Calender Adjunct

U.S. 2,801,439, issued August 6, 1957 to John S. Meares, assigned to E.I. du Pont de Nemours & Co., provides an ancillary piercing roll for use with calenders, which eliminates the formation of bubbles and blister streaks in calendered films and coatings calendered on flexible substrates.

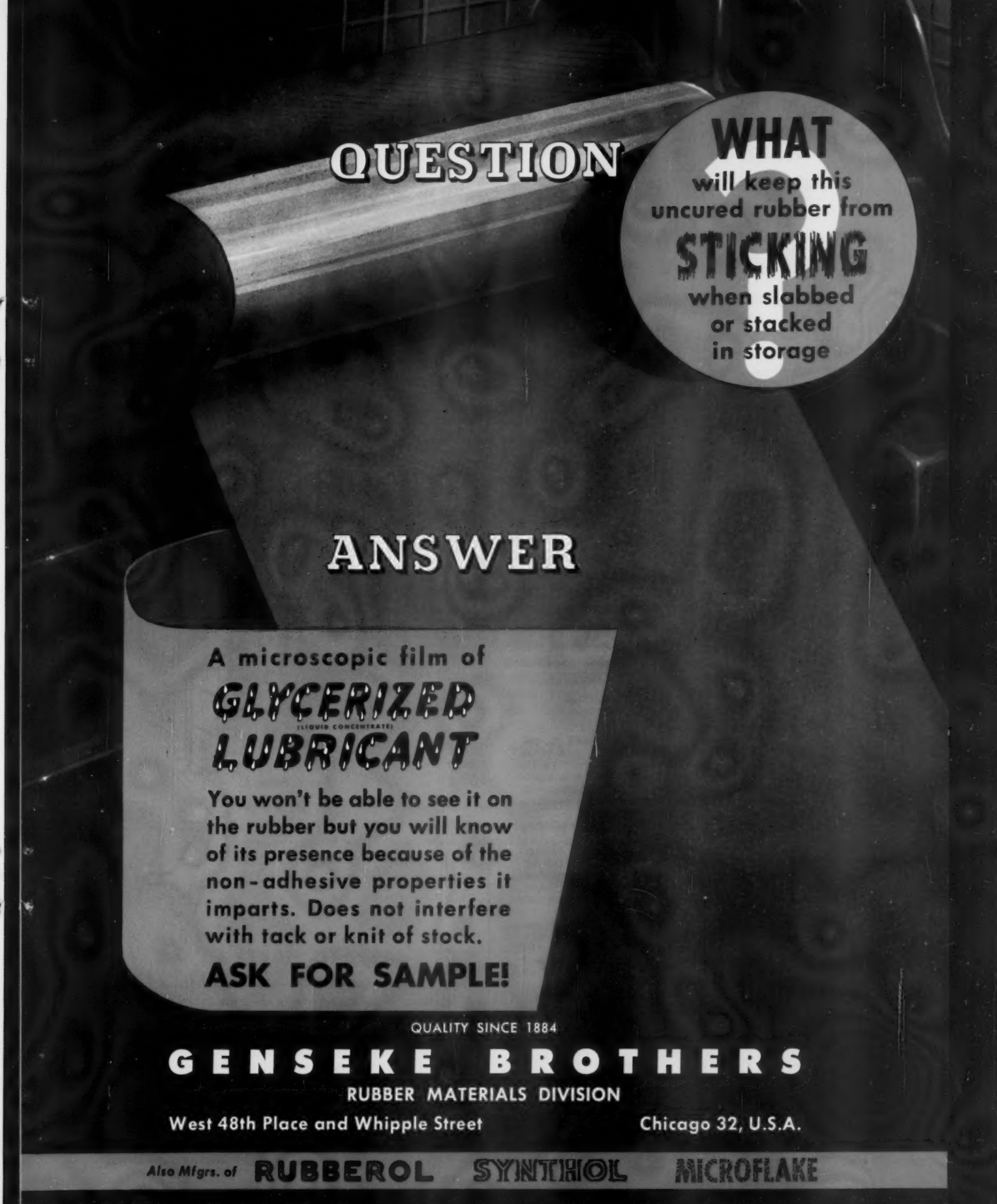


The piercing roll has a number of spring loaded piercing elements. The pressure applied by the piercing elements is uniform and self-adjusting. The illustration on the left shows the piercing roll (6) with piercing elements (7) used in conjunction with a three-roll calender. On the right is seen the mounting of an individual piercing element, a knife blade with an angular cutting edge (7), on the piercing roll (6). The shank of the knife (7) fits into a slit in the end of the conical shaped bolt (9). As the nut (11) is tightened, the enlarged end of the bolt (9) is drawn downward into the cartridge (10).

Method of Making Nylon Tires

U. S. 2,790,482, issued April 30, 1957 to Mart B. Riggs and assigned to Goodyear Tire & Rubber Co., relates to the manufacture of tires having reinforcing fabric plies made of nylon.

Considerable difficulty has been experienced with nylon because as the tire is cured the nylon cords shrink, so that the turned circumferential marginal edges of the outer plies which terminate in the area of the toe of the bead are pulled toward the heel of the bead. After cure they are disposed in the area of the heel so that very


QUESTION
WHAT
will keep this
uncured rubber from
STICKING
when slabbed
or stacked
in storage
?
ANSWER
A microscopic film of
GLYCERIZED
(LIQUID CONCENTRATE)
LUBRICANT
You won't be able to see it on the rubber but you will know of its presence because of the non-adhesive properties it imparts. Does not interfere with tack or knit of stock.
ASK FOR SAMPLE!
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Also Mfgrs. of RUBBEROL SYNTHOL MICROFLAKE

BE SURE-

your product will withstand exposure to weathering

ATLAS Weather-Ometer®

tests will give you the facts

MODEL DMC

Greater accuracy and reproducibility achieved with new modulated temperature control.

Accuracy in test results is greatly increased in the new DMC Weather-Ometer by a positive control of specimen temperatures.

A constant volume of air at a controlled temperature in the heavily insulated cabinet, maintains uniform predetermined specimen temperatures regardless of variations in room conditions.

Automatic control of humidities up to dew point is available as optional equipment.

All automatic controls including complete voltage controls are located on the front panel of the Weather-Ometer directly above the door of the test chamber.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid materials and vertical panels for solid materials.

Source of radiation is two Atlas enclosed violet carbon arcs.

Complete technical information on the DMC model and other Weather-Ometers is contained in the new Weather-Ometer catalog. A copy will be mailed on request.

ATLAS ELECTRIC DEVICES CO.

4114 N. Ravenswood Ave., Chicago 13, Illinois

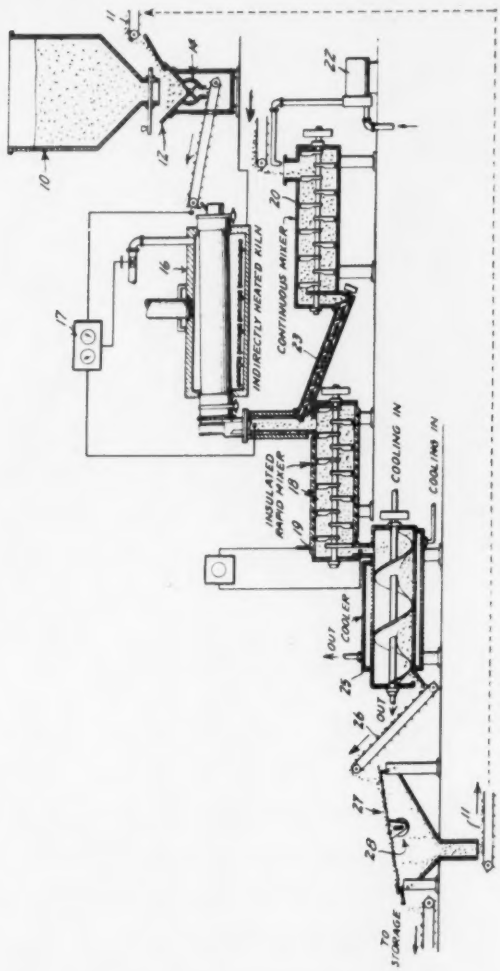
Manufacturers of accelerated testing equipment for over a quarter of a century.

PATENT REVIEW

little snub or bite around the beads remains in the outer plies. The present patent provides a method of overcoming this defect.

Reclaimed Rubber in Discrete Particle Form

US. 2,800,462, issued July 23, 1957 to Edward F. Sverdrup, assigned to U.S. Rubber Reclaiming Co., Inc., describes a method of producing reclaimed rubber in discrete-particle form.



As shown in the illustration, a suitable powder, such as whiting, is conducted from a storage bin (10) and return conveyor (11) to a surge hopper (12) and then through a constant-rate feeder (14) into a rotary kiln (16) which is indirectly heated under control of a thermostat (17). From the kiln it is delivered at 450 to 750°F. to an insulated rapid mixer (18), in which the temperature is maintained by heating elements (19).

Crumb rubber (30 to 40 mesh) is carried through a

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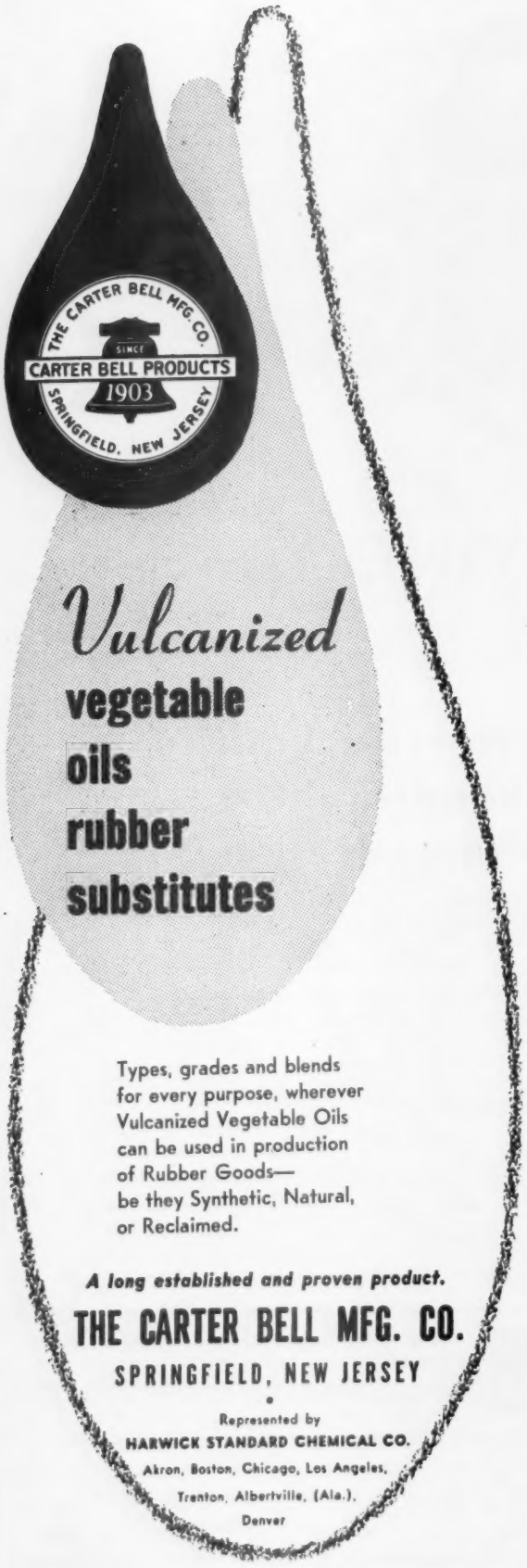

PATENT REVIEW

continuous mixer (20), to which reclaiming oils and suitable chemical or other reclaiming agents are introduced by a proportioning pump (22). The material from the crumb mixer (20) is fed by a conveyor (23) into the insulated mixer (18), together with hot powder from the kiln (16). This powder, as it is intensively mixed with the crumb rubber by the mixer (18), acts as a heat transfer medium and as a dusting agent to keep the individual particles separate and in free motion. Thus the individual particles of crumb rubber are heated rapidly and uniformly to effective devulcanizing temperature. The mass of powder may also serve to control oxidation of each particle by effectively surrounding it with inert powder particles so as to prevent undesirable access of oxygen. In the chamber (18), the loose mixture of hot whiting and crumb rubber rapidly reach a uniform temperature of 300 to 450°F. Due to the rapid heating, the devulcanization reaction begins at once, and proceeds uniformly throughout the rubber.

As the mixture of powder and rubber crumb leaves the mixer (18), it falls into a cooler (25) which rapidly cools the mass to 70 to 150°F. From the cooler, the mass is fed by conveyor (26) onto a vibrating 80-mesh screen (27), through which the excess whiting falls onto a conveyor (11), from which it is conducted back to surge hopper (12).

Plasticizing Rubber with Aminothiophenol Salts

U.S. 2,787,605 and 2,787,621, issued April 2, 1957 to Edwin O. Hook and Arnold R. Davis, assigned to American Cyanamid Co., describe a method for plasticizing an unvulcanized elastomer by hot mastication, the elastomer being either vulcanizable natural rubber or synthetic rubberlike butadiene-1, 3 polymers. The plasticizer used is a zinc salt of an acylated aminothiophenol, for example, zinc o-benzamidothiophenate.

According to the inventors, plasticizers of this type are free "to a startling degree" of such objections as toxicity, skin irritation, odor, ineffectiveness at low temperature, instability in storage, or ineffectiveness with either natural rubber or synthetic rubberlike polymers.

Vulcanization of Butadiene Rubbers

U.S. 2,797,204, issued June 25, 1957 to Alvin F. Shepard, Joseph T. Cardone, and Albert S. Jacobson, assigned to Hooker Electrochemical Co., relates to the vulcanization of 1, 3-butadiene polymers with the reaction products of formaldehyde and 3, 4, 5-trialkylphenol.

These vulcanizing agents have a three-fold function. First, they serve as plasticizing agents, eliminating the need for additional plasticizing agents. Second, they act as vulcanizing agents. Finally, they serve as antioxidants, protecting the ultimate product from the action of heat and oxygen.

The products of the invention exhibit high tensile strength, in many cases almost 4,000 pounds per square inch, high elongation, and excellent solvent resistance to

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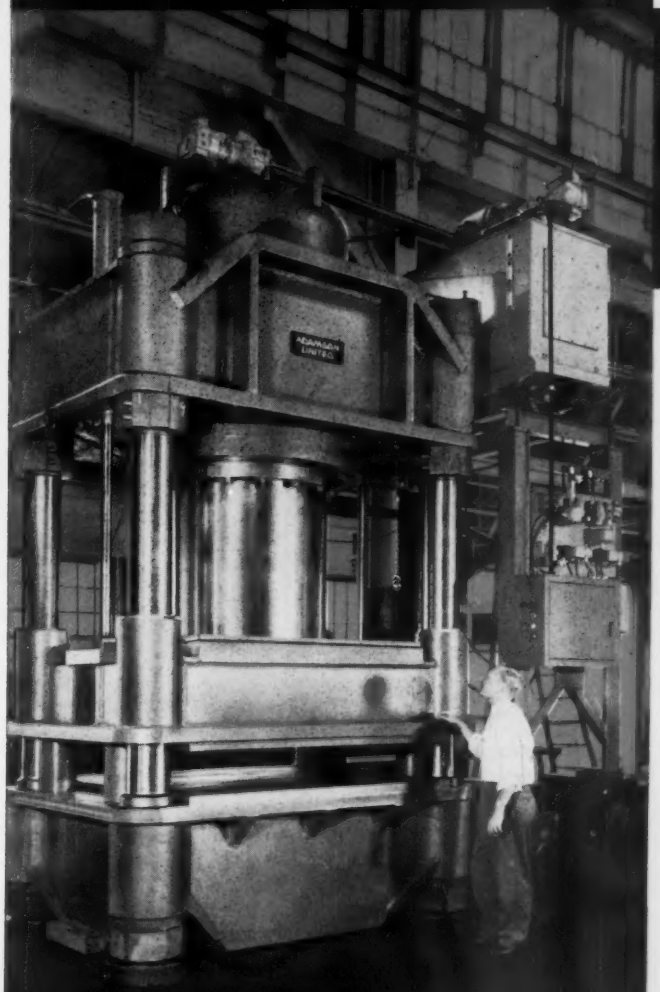

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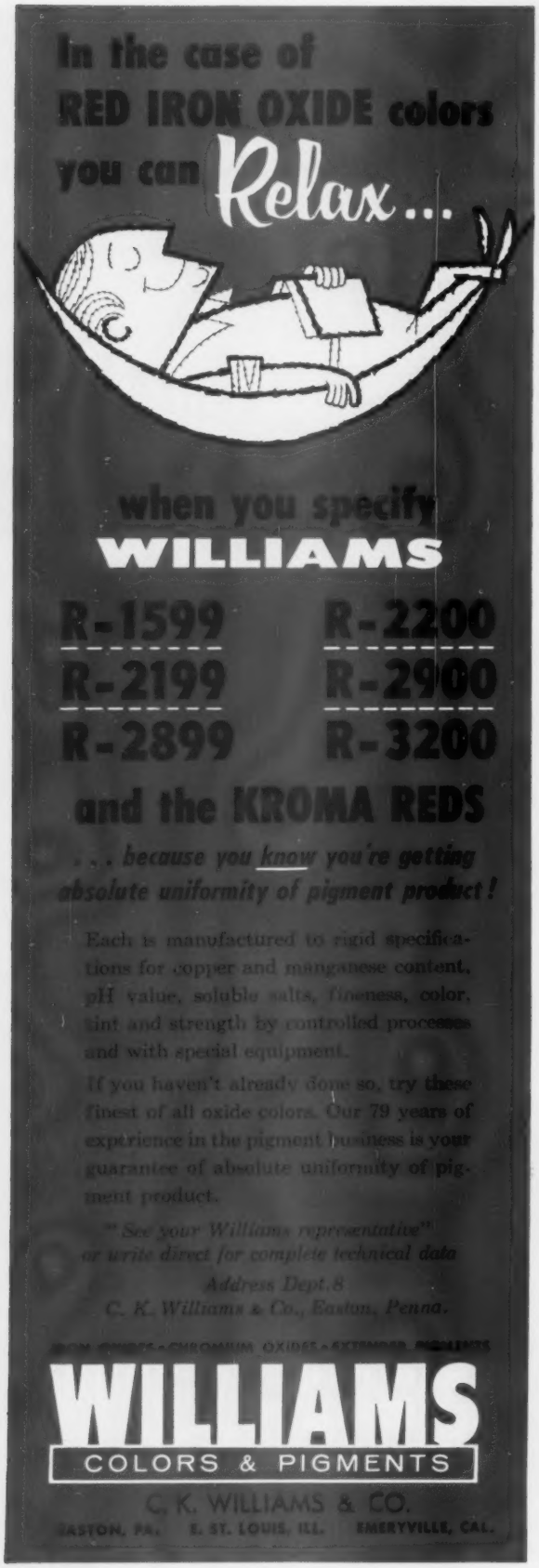
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PATENT REVIEW

such solvents as benzene, toluene and carbon tetrachloride. Unlike sulfur vulcanizates, they show no tendency to bloom, and they are highly resistant to change in mechanical and electrical properties on heat aging.

Polymerization of Butadiene Hydrocarbons

U.S. 2,787,609, issued April 2, 1957 to Bailey Bennett and assigned to Secretary of the Army, provides a new method of polymerizing butadiene hydrocarbons or mixtures of butadiene hydrocarbons with copolymerizable vinyl compounds in aqueous emulsion in the presence of arylalkyl selenol compounds.

The selenols behave in a manner similar to that of mercaptans in emulsion polymerization, but with reduced activity at any given polymerization temperature. Therefore, they can be used as modifiers at temperatures up to 150°C.

Urea Type Anti-Exposure Cracking Agents

U.S. 2,788,388, issued April 9, 1957 to Richard O. Zerbe and assigned to Monsanto Chemical Co., discloses the fact that certain urea compounds are effective against exposure cracking.

Among the urea compounds disclosed in the patent are dicyclohexyl alkoxy phenyl ureas and 2, 4¹-Diethoxy carbanilide.

Other Patents Of Interest

Subject	Inventor or Assignee	Patent No.	Date
Centering means for tire retreading machines	National Industries, Inc.	2,793,397	5/28/57
Suction press roll	United States Rubber Co.	2,793,571	5/28/57
Truck tube splicing method	Fredrick D. Simpson	2,793,675	5/28/57
Process of short-stopping polyolefinic compounds using alkali metal trithiocarbonate	General Tire & Rubber Co.	2,794,011	5/28/57
Catalytic process for making esters of alpha-olefinic n-carbamylic acid	United States Rubber Co.	2,794,012	5/28/57
Sealing gasket	Pawling Rubber Corp.	2,794,221	6/4/57

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.

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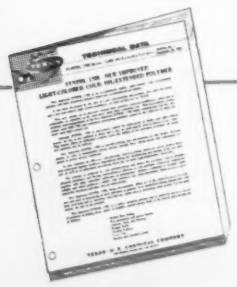
BUTADIENE-STYRENE SYNTHETIC RUBBERS

SYNPOL	HOT TYPES						
	1000	1001	1002	1006	1007	1009	1012
DESCRIPTION							
Emulsifier Stabilizer	Fatty Acid Staining	Fatty Acid Slightly Staining	Rosin Acid Staining	Fatty Acid Non-Staining	Fatty Acid Staining	Fatty Acid Non-Staining	Fatty Acid Non-Staining
Miscellaneous				Non-Discoloring	Glue Acid coagulated	Non-Discoloring Divinylbenzene Terpolymer	Non-Discoloring
SPECIFICATIONS							
CHEMICAL							
Volatile Matter (Max.)	0.50	0.50	0.50	0.50	0.50	0.75	0.50
Ash (Max.)	1.50	1.50	1.50	1.50	0.50	1.50	1.50
Organic Acid	4.00–6.25	4.00–6.25	3.75–6.00	3.75–6.00	3.75–6.00	3.75–6.00	4.25–6.50
Soap (Max.)	0.75	0.75	0.75	0.75	0.25	0.75	0.50
Bound Styrene	22.5–24.5	22.5–24.5	22.5–24.5	22.5–24.5	22.5–24.5	22.5–24.5	22.5–24.5
Stabilizer	1.00–1.75	1.00–1.75	1.00–1.75	1.25 added	1.00–1.75	1.25 added	1.25 added
PHYSICAL							
Raw Viscosity	44–52	44–52	50–58	46–54	45–55		95–115
Cpd. Viscosity (Max.)	73	73	65	73	73	115–135	120
Tensile psi (Min.)	2700	2500	2700	2500	2400	1600	2900
Elongation % (Min.)	550	500	550	500	500	300	450
#Modulus psi 25′	300–600	325–625	300–600	400–700	450–750	400–700**	550–1000
#Modulus psi 50′	800–1150	750–1100	750–1100	825–1175	775–1125	600–950**	1200–1700
#Modulus psi 100′	1250–1650	1200–1600	1125–1525	1300–1700	1125–1525	850–1250**	1750–2250
Water Soluble Ash % (Max.)					0.35		
Water Absorption mg./sq. cm. (Max.)					1.50		
Shrinkage % (Max.)						25.0	
Oil—Parts							
Oil—Type							
REMARKS	A general purpose hot rubber adaptable to most black products where color is unimportant.	More resistant to staining and discoloring than 1002.	Higher tensile and lower modulus incured compounds than 1000 or 1001. Slower curing.	General purpose, non-discoloring and non-staining polymer.	Glue acid coagulated staining polymer with relatively low water absorption, low ash, and good electrical properties.	A non-staining cross linked polymer. Use of small quantities with other type polymers reduces shrinkage and die-swell in calender and extrusion operations.	A high-Mooney polymer for solution applications.
APPLICATIONS	Tires, molded and extruded mechanical goods and any other general purpose application.	Tires, molded and extruded mechanical goods, shoe soles & heels.	Tires, molded and extruded mechanical goods.	Light colored and white products, such as white sidewall tires, shoe soles, floor tile and toys.	Wire and cable insulation, electrical tape, gaskets, hard rubber products, etc.	Wherever control of shrinkage is important. Footwear, wire and cable insulations, calendered sheet goods, soles and heels. Can be used with Natural Rubber and Neoprene.	Asbestos sheet packing.



PRE-TESTED COMPOUNDING FORMULAS FOR SYNPOL 1708

Actual cost-tested compound formulas for Molded Soles, Code Wire Insulation, Floor Tile, and other products are included in this New SYNPOL 1708 Bulletin.

This is the first in a series of Technical Bulletins offering comprehensive data covering descriptions and specifications, physical properties, typical production values, and specific product applications for TEXUS SYNPOLS. For your free copy, contact your local TEXUS representative or Naugatuck Chemical, Naugatuck, Conn.—SYNPOL Sales Agent.

†Based on rubber hydrocarbon content

#300% Elongation

**Synpol 1009 Moduli @ 200% Elongation

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NEW IMPROVED SYNPOLS*

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In addition to their economical use in current products, the outstanding characteristics of the new 1703, 1707 and 1708 SYNPOLS offer exciting possibilities for new product development.

TEXUS Technical Service is always ready to assist you on any product or processing problems, and complete SYNPOL technical data will be sent promptly upon request.

	COLD TYPES				COLD OIL-EXTENDED TYPES				
1013	1061	1500	1502	1551	1703*	1707*	1708*	1711	1712
Fatty Acid Non-Staining Non-Discoloring Alum Coagulated High styrene	Fatty Acid Non-Staining Non-Discoloring	Rosin Acid Staining	Mixed Soap Non-Staining Non-Discoloring	Rosin Acid Non-Staining Non-Discoloring	Mixed Soap Non-Staining Non-Discoloring	Rosin Acid Non-Staining Non-Discoloring	Potassium Fatty Acid Non-Staining Non-Discoloring	Rosin Acid Staining	Mixed Soap Staining
1.00 1.25 4.00—6.00 0.01 42.0—44.0 1.25 added	0.50 1.50 4.00—6.25 0.75 22.5—24.5 1.25 added	0.75 1.50 5.00—7.25 0.50 22.5—24.5 1.00—1.75	0.75 1.50 4.75—7.00 0.50 22.5—24.5 1.25 added	0.75 1.50 5.00—7.25 0.50 22.5—24.5 1.25 added	0.75 1.50 4.50—6.30 0.50 22.5—24.5 1.25 added†	0.75 1.50 3.90—5.70 0.50 22.5—24.5 1.25 added†	0.75 0.50 3.90—5.70 0.50 22.5—24.5 1.25 added†	0.75 1.50 3.90—5.70 0.50 22.5—24.5 1.25 added†	0.75 1.50 3.90—5.70 0.50 22.5—24.5 1.25 added†
40—50 73 2500 600 350—750 775—1175 1250—1750	44—52 73 2500 500 325—625 750—1100 1200—1600	46—58 73 3800 600 300—650 800—1200 1200—1700	46—58 73 3100 575 350—650 775—1125 1250—1650	46—58 73 3600 600 300—650 800—1200 1200—1700	50—70 25 Naphthenic	45—65 37.5 Naphthenic	50—70 0.35 1.50 37.5 Naphthenic	45—65 37.5 Highly Aromatic	45—65 37.5 Highly Aromatic
A high styrene, non-staining and non-discoloring polymer.	Similar to 1006, with Polygard stabilizer.	A general purpose cold rubber for use where color and staining is unimportant.	Non-discoloring and non-staining cold rubber. Higher physicals than 1006 and 1061	A general purpose non-staining and non-discoloring cold rubber, based on recipe for 1500	A general purpose non-discoloring, non-staining oil-extended polymer.	Similar to 1703. Emulsified with rosin soap rather than mixed soap.	Non-discoloring and non-staining polymer, low ash content and water absorption values, resulting in good electrical properties.	Similar to 1712, emulsified with rosin soap rather than mixed soap.	General purpose oil-extended polymer for use where color and staining is unimportant.
Calendered goods, closures, can sealants, adhesives.	Light colored and white products such as white sidewall tires, shoe soles, floor tile and toys.	Tires, camelback, molded and extruded mechanical goods.	For light colored and white products such as white sidewall tires, white and light colored mechanical goods, floor tile, hospital sheeting, toys, soles and heels.	For general use where non-staining characteristics are important.	Competitive grade for light colored and white products, tires, mechanical goods, floor tile, shoe soles and heels.	Tires, camelback, heels, molded and extruded mechanical goods.	Competitive grade for wire and cable insulation; certain electrical goods, coated fabrics, molded and extruded mechanical goods, soles and heels.	Tires and camelback.	Tires, camelback, molded and extruded mechanical goods.

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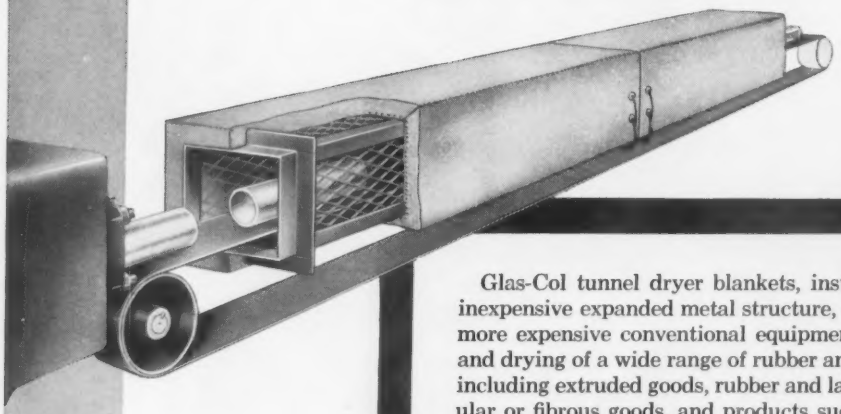

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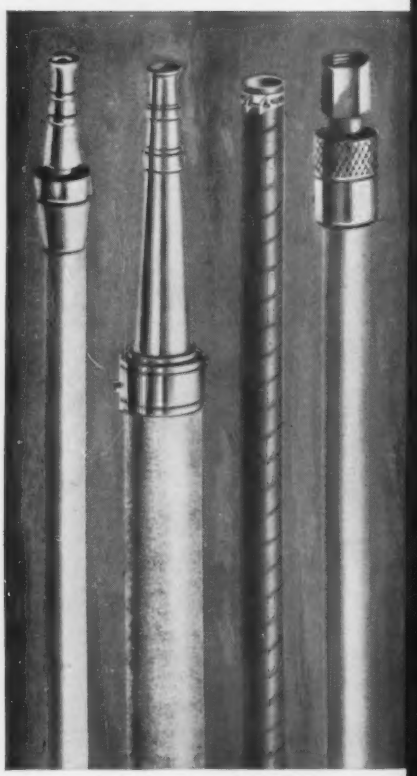

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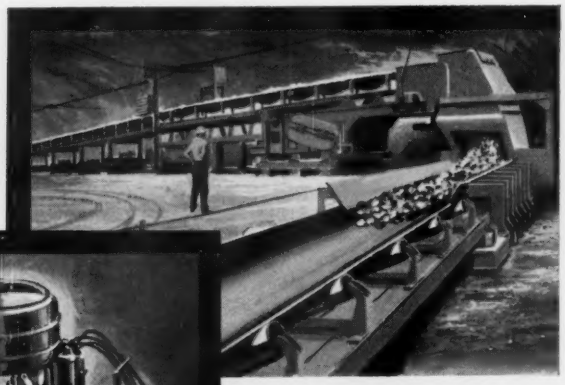

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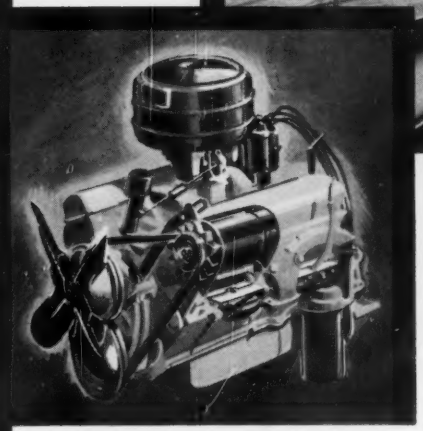
Resistant to temperature changes, dimensionally stable through all weather, neither sagging nor stretching despite long pitches, Fortisan-36 delivers the goods!



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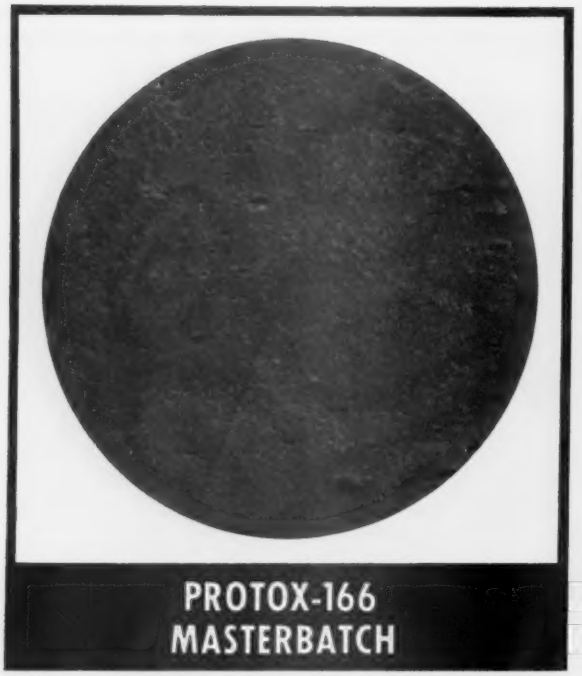
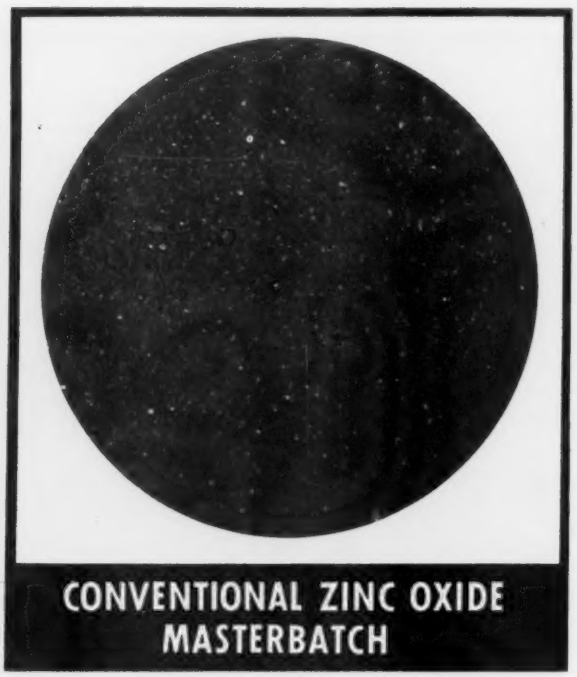


PROTOX-166
MASTERBATCH



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WHY PROTOX-166 ZINC OXIDE DISPERSES FAST IN *ANY* RUBBER

Customers tell us that Protox-166, unlike conventional zinc oxides, disperses well in *any* type of rubber batch (natural or synthetic) over a wide range of Mooney viscosity.

HERE'S WHY:

1. **Protox-166 mixes into rubber without forming hard-to-disperse aggregates.**
2. **Protox-166 particles are electrically attracted by rubber.**
3. **Protox-166 particles are readily wet by all types of rubbers.**

These features stem from the unique coating of zinc propionate on the Protox-166 particles.

Our sales representatives will be glad to discuss how you can use these features to advantage in your compounding.

THE NEW JERSEY ZINC COMPANY

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Yarn construction is a major factor in the "engineering" of base fabrics!

The construction of the yarn from which a base fabric will be woven pre-determines a number of fabric characteristics. Breaking strength, flexibility, bulking, absorption, and adhesion to other materials are affected by such things as type of fiber, yarn size and weight, twist, plies, and many other factors.

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Another first from Monsanto

SANTOFLEX AW... antiozonant pioneer guards rubber against cracking caused by ozone attack... sets the "standard for comparison"

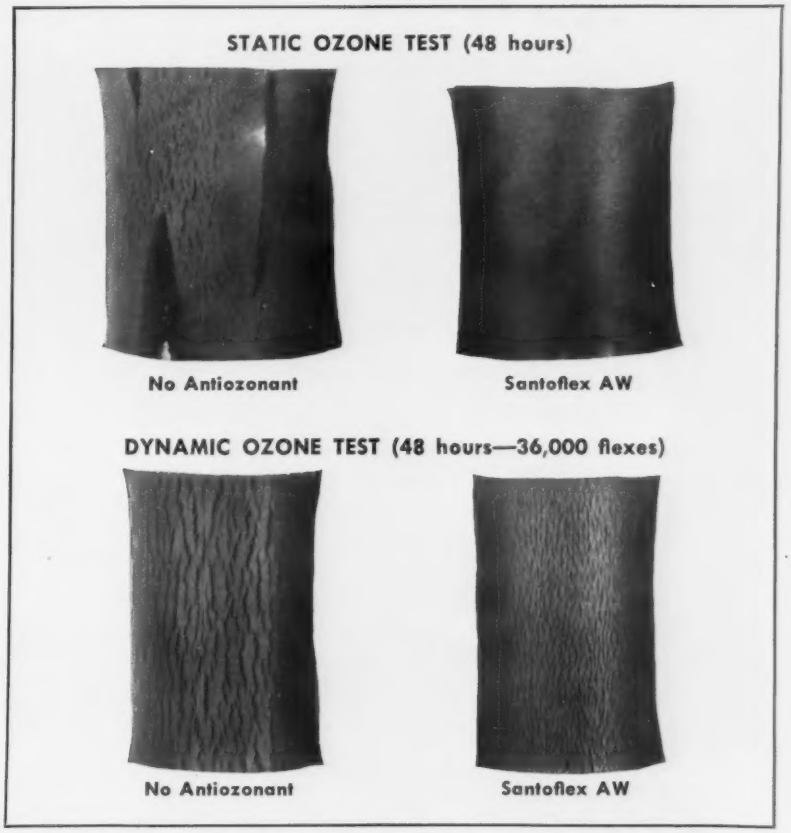
"Small but virulent" aptly describes ozone as it acts on rubber. In today's technology, ozone is recognized as the insidious culprit it is... often the cause of troubles previously attributed to poor compounds, excessive flexing, sunshine and heat! Ozone's drastic effect on the physical properties of rubber under stress shows up in the formation of cracks—a few deep ones or a myriad of small ones.

Although ozone rarely occurs naturally in concentrations as high as 50 parts per 100 million parts of air, it is universally present in the atmosphere, *always* a threat to rubber, especially under dynamic stress, and even when stored under static load. Santoflex vaccinates styrene-butadiene rubber, as well as natural and nitrile rubbers, against ozone attack.

Like the blooming type of waxes and other antiozonants, Santoflex AW is capable of slow migration to supply a continuous protective barrier. But unlike wax, which is often undesirable and ineffective because the wax film ruptures upon flexing, Santoflex AW retards flex cracking even under dynamic stress.

Quantity needed to materially reduce or eliminate cracking due to ozone attack will vary with the compound and the severity of attack, but usually a level of 2.0% on the rubber content is a safe amount for protection in average cases. If both static and dynamic service conditions are involved, a small amount of blooming wax (paraffin wax with a 135-145° F. melting point, for example) will usually reinforce the antiozonant protection of Santoflex AW.

Santoflex AW was the first commercial antiozonant for rubber... and through its twelve years' successful use in tire sidewalls, power-cable insulation and other electrical applications, tubing, motor mounts and similar products, sets the highest "standard for comparison" of ozone protection. When you suspect your compounds will be exposed to ozone attack under stress, if you come up against a flex-cracking problem caused by ozone, or if you are now using another antiozonant, try Santoflex AW and *see* the difference *it* makes. We'll be glad to help. Just write:



See the difference Santoflex AW makes in tire tread stock placed under stress and exposed to approximately 50 parts of ozone per 100 million parts of air for 48 hours.

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Rubber Chemicals Department
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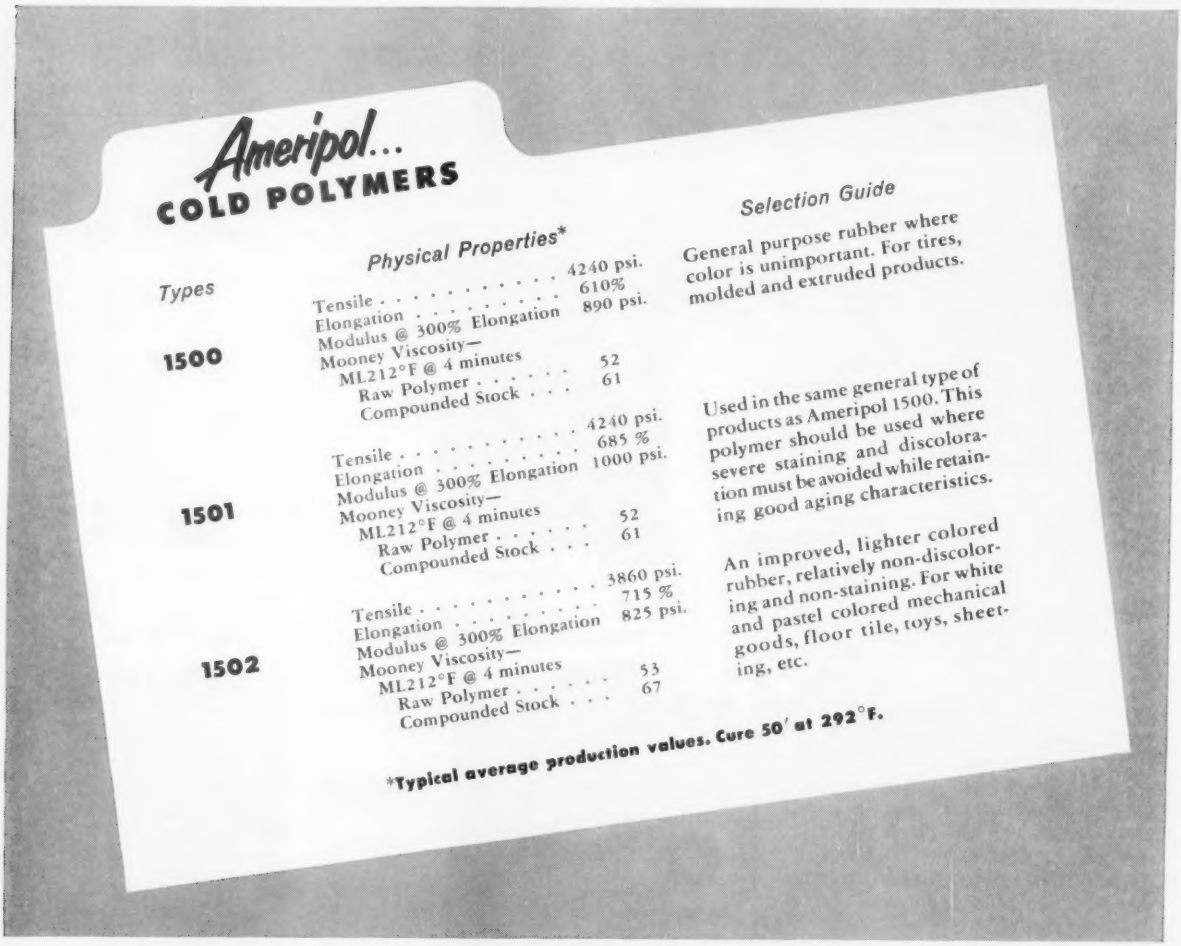
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Physical Properties*
Selection Guide
Types
1500
Tensile . . . . . 4240 psi.
Elongation 610%
Modulus @ 300% Elongation 890 psi.
Mooney Viscosity—
ML212°F @ 4 minutes
Raw Polymer 52
Compounded Stock . . . 61
General purpose rubber where color is unimportant. For tires, molded and extruded products.
1501
Tensile . . . . . 4240 psi.
Elongation . . . . . 685 %
Modulus @ 300% Elongation 1000 psi.
Mooney Viscosity—
ML212°F @ 4 minutes
Raw Polymer 52
Compounded Stock . . . 61
Used in the same general type of products as Ameripol 1500. This polymer should be used where severe staining and discoloration must be avoided while retaining good aging characteristics.
1502
Tensile . . . . . 3860 psi.
Elongation . . . . . 715 %
Modulus @ 300% Elongation 825 psi.
Mooney Viscosity—
ML212°F @ 4 minutes
Raw Polymer 53
Compounded Stock . . . 67
An improved, lighter colored rubber, relatively non-discoloring and non-staining. For white and pastel colored mechanical goods, floor tile, toys, sheeting, etc.
*Typical average production values. Cure 50′ at 292°F.

Choose cold polymer man-made rubber for superior flexing, wear, abrasion resistance

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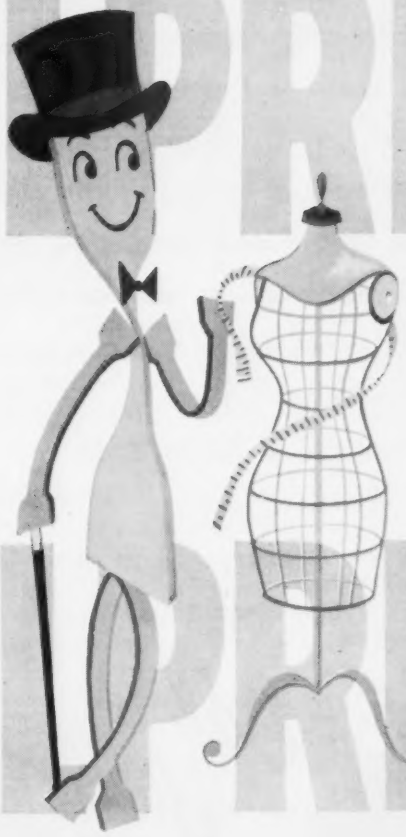

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COLD	PHILPRENE 1500 PHILPRENE 1502 PHILPRENE 1503	PHILPRENE 1600 PHILPRENE 1601 PHILPRENE 1605
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Available in either liquid or powder form.

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Capitol Cues

THE BUSINESS OUTLOOK for 1958 has now taken fairly firm shape in the thinking of leading government and industry economists. They see the coming 12 months as an essentially good period—very much like the one just ending. Sure, they see signs of ease—potential trouble spots that must be watched. But basically the economy is in good shape. There will be no slump in 1958.

No one wants to minimize the importance of recent unfavorable developments—the dips in industrial output, personal income, and retail sales. Then, too, Eisenhower's illness introduced an element of uncertainty for a while. But the missile crisis foreshadows powerful lifting forces. And the government will take anti-recession action—easing of money, etc.—as needed.

GOVERNMENT SPENDING WILL SET THE TONE for 1958 in the way spending for new plant and equipment has been the dynamic factor during '56 and '57. Falling federal expenditures, resulting from ex-Secretary Wilson's cuts, are heavily responsible for the current business softening. But spending will start rebounding in the Spring as work on missiles is noticeably stepped up. And non-defense costs will climb—for farm aid, foreign aid, debt interest.

State-local outlays will keep rising, too, at the rapid clip of recent years as many long-delayed public works are pushed. Buying by consumers will also stay high, adding further lift.

THE FIRST HALF WILL BE A PERIOD OF EASING or even mild decline, in all probability. Total output of goods and services is likely to be down a shade, at least in physical terms. But, later in the year—with the coming of Summer—the analysts think that the economy will get back on an uptrend.

Here is what will happen to key economic indicators in 1958:

- Total output of goods and services will rise 2% or so. Gross National Product will hit $446 billion, up from $436 billion in 1957. Half the gain will reflect slightly higher prices.
- Personal income will rise $9 billion—2.7%—to $353 billion.
- Consumer spending will be up $10 billion, to $290 billion. (Folks may save less of incomes.) Soft goods will do well.
- Industrial production—that is, mining and manufacturing—will average out at 142% of the 1947-49 base period; 1957 seems to be averaging out around 144%. (Rate is now 142%.)
- Employment will decline slightly—maybe 300,000 on average—from the 1957 figure of 65 million. Rising productivity will be the main reason that the job total will be shrinking.
- Unemployment will rise an average of 800,000—to 3.6 million; there won't be jobs for all workers added to the work force. It will top 4 million at seasonal peaks in February and June.

PRICES WILL EDGE UP SOME IN 1958, but not as rapidly as during the past year or more. Past cost hikes are still passing to the finished goods and retail stages. And stepped-up missile work may make some items scarcer.

There'll be no slowdown in wage increases in 1958, however. Unionized workers will get hikes of 10¢ an hour or more. The Auto Workers may possibly lead the way to even larger gains.

Continued on Next Page

CREDIT WILL BE EASIER IN 1958 for two big reasons—natural economic forces and actions of the Federal Reserve Board. First, demand for credit will be down—with business investment in inventories and new plant. Also, officials may inject fresh money into the economy as an aid to business and as a step to insure that the first-half softening does not get out of hand. Interest rates may fall some more, though not to the lows of 1953 and 1954.

RELATIVELY MORE FIRMS WILL SHOW LOSSES during 1958—especially in the soft first half—because of rising costs and competition. They'll be casualties of the fight to increase or at least hold the share of a market that won't be growing much. Good management will pay off as never before.

Not all industries will do well, though a good number will end 1958 with pluses. Here's what forecasters see for key lines:

CONSTRUCTION IS HEADING FOR A RECORD YEAR—another one—in 1958. Dollar spending will rise 5%, to $49 billion. Prices will account for half of the increase—meaning that there will be some real, physical gains, too. Lack of money or materials won't be hampering activity, as in recent years.

- Public spending will jump 10%. Public housing will rise 33%; industrial building, 20%; hospitals, schools and roads, 7%.
- Private outlays will rise only 1%-plus, reversing the 1956-57 pattern. Factory & commercial work will fall; home-building will rise. Housing starts will climb 100,000, to 1.1 million.

The year 1958 will be a good one for building materials, too. Consumption of cement will be up 5%; clay products—2% to 3%; paints—2% or 3%; in lumber—sales will jump, with housing.

STEEL PRODUCTION WILL ONLY MATCH 1957'S in the next 12 months. The mills will ship 115 million ingot tons, also the 1956 figure. With capacity up 5 million tons—to 145 million—operating rate will dip to 82% from 86%. Shortages—even of structural and plate—may be over by the end of the year.

The 1958 non-ferrous metals outlook is also one of stability. With inventories down some, copper, lead and zinc demand will firm—and prices, too. There will also be a bit more nickel. Aluminum will be the exception; consumption will be up 10%.

SPOTTY WILL BE THE WORD FOR MACHINERY and industrial equipment in 1958. The dip in spending for plant and equipment will depress some lines. But some other types will benefit from automation and utilities expansion.

Here's the outlook, as government experts see it, line by line:

- Construction: '58 sales will match '57's expected $2 billion.
- Office types: The 1957 gain was 22%. In '58, it will be 10% or 15%, sparked by demand for large sorters and calculators. Cash register sales may be sluggish during 1958's first half.
- Farm equipment: Sales will pick up some—replacement orders.
- Other types: Sales of mining machinery will fall 5%; power, up 10%; oilfield equipment, up 20%; textiles, off 15% or 20%.
- Machine tools: Defense and replacement sales may offset falling demand from expansion of civilian plant—and keep sales up.

Poor Princess! Because a dried pea had been placed under her stacked swansdown mattresses, morning found the legendary lass black, blue and yawning. Of course, this test of her royal sensitivity wouldn't have worked with *foam rubber* mattresses made from Shell Chemical's latex.

For mattresses—or any other product made of rubber—Shell Chemical produces a full line of butadiene-styrene synthetic rubber . . . hot, cold, oil extended and black masterbatch, as well as hot and cold latices.

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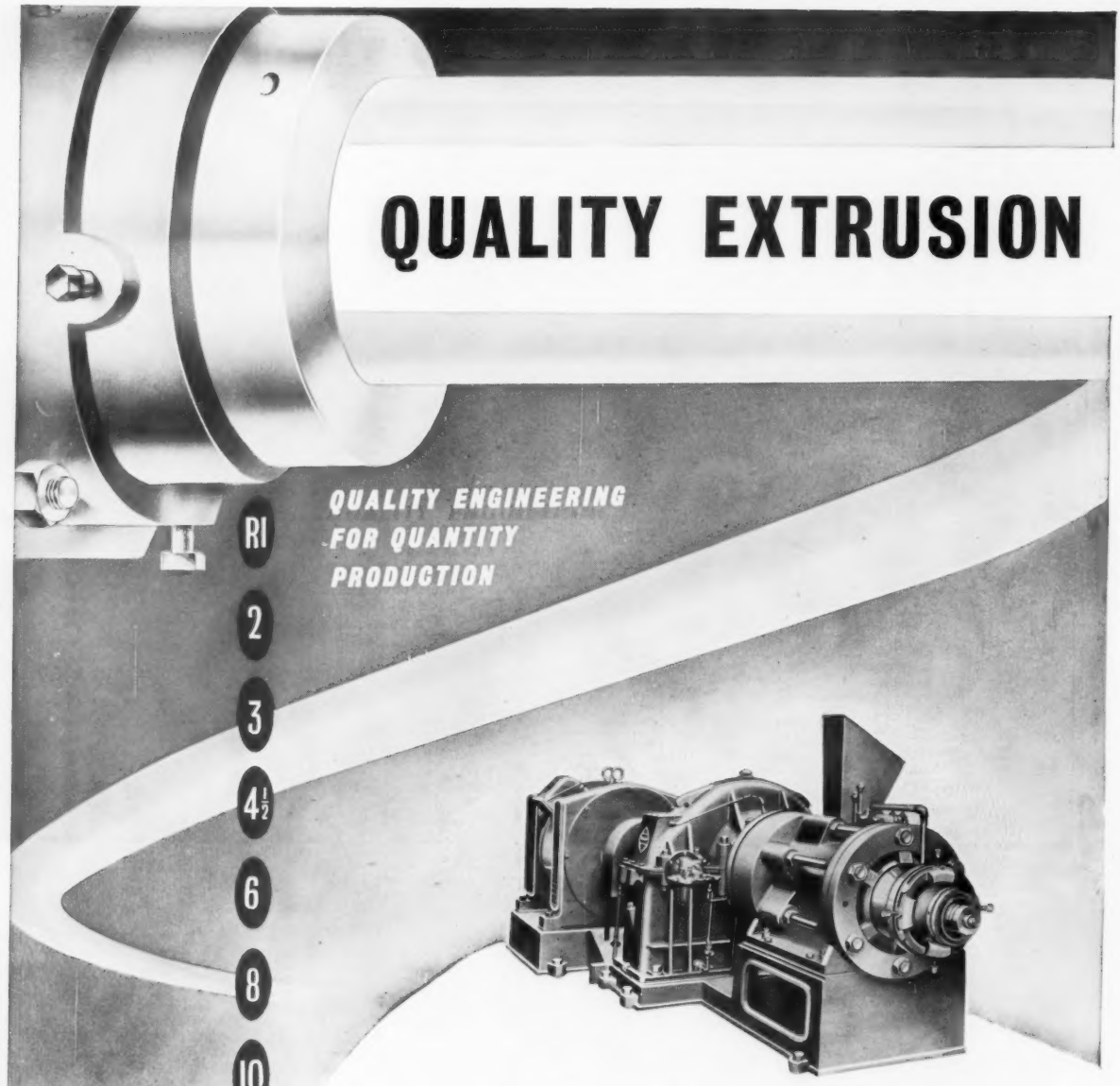

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cuts cost of ozone protection

Rubber products require safeguards against the serious deteriorating effects of ozone. Yet, you may be spending more than you need spend for this protection.

Eastozone—Eastman rubber antiozonants—guard against ozone attack more effectively at *lower cost* than do other types of commercially available antiozonants.

By using Eastozone in rubber recipes, compounders often can cut antiozonants concentration in half and get equal ozone protection. measured by static or dynamic ozone exposure tests. At current prices, this lower concentration can mean a saving of as much as 20¢ on your antiozonant dollar.

Eastozone antiozonants are easily incorporated into the rubber formula during processing. They slowly exude to the surface of the finished rubber product, affording long-lasting protection against checking and cracking caused by atmospheric ozone.

For economical and effective ozone protection, specify Eastman antiozonants for your rubber recipes. Ask your Eastman representative today for samples of Eastozone 30 and Eastozone 31 for evaluation by your laboratory staff, or write to Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, Kingsport, Tennessee.

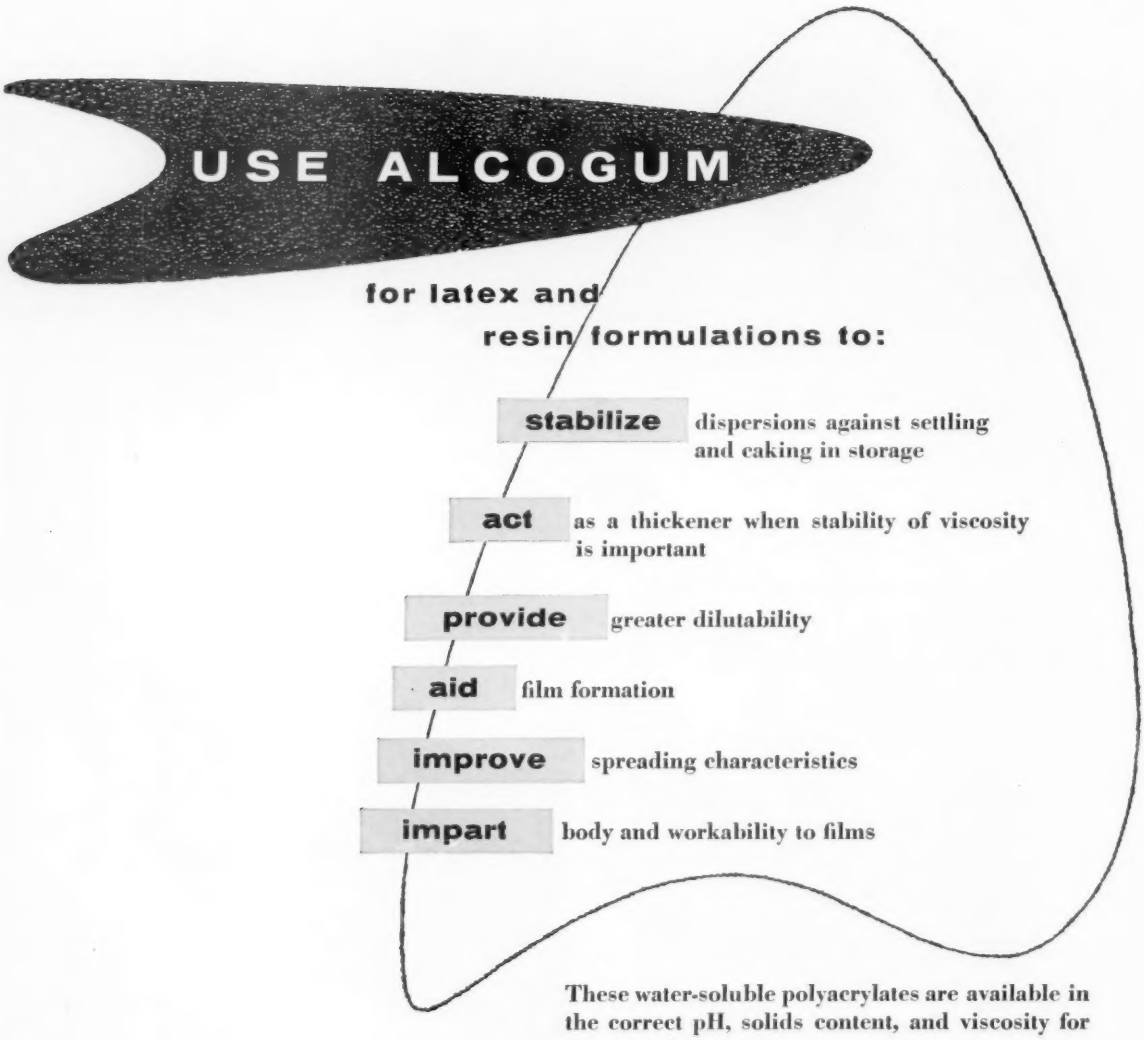
Chemical Description of Eastman Antiozonants

Eastozone 30	N,N'-di-2-octyl p-phenylenediamine
Eastozone 31	N,N'-di-3-(5-methylheptyl) p-phenylenediamine

(formerly Tenamene 30 and 31)

Eastozone Eastman Rubber Antiozonants

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tennessee; New York City; Framingham, Massachusetts; Cincinnati; Cleveland; Chicago; St. Louis; Houston. **West Coast: Wilson Meyer Co.,** San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.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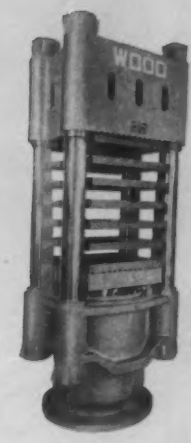

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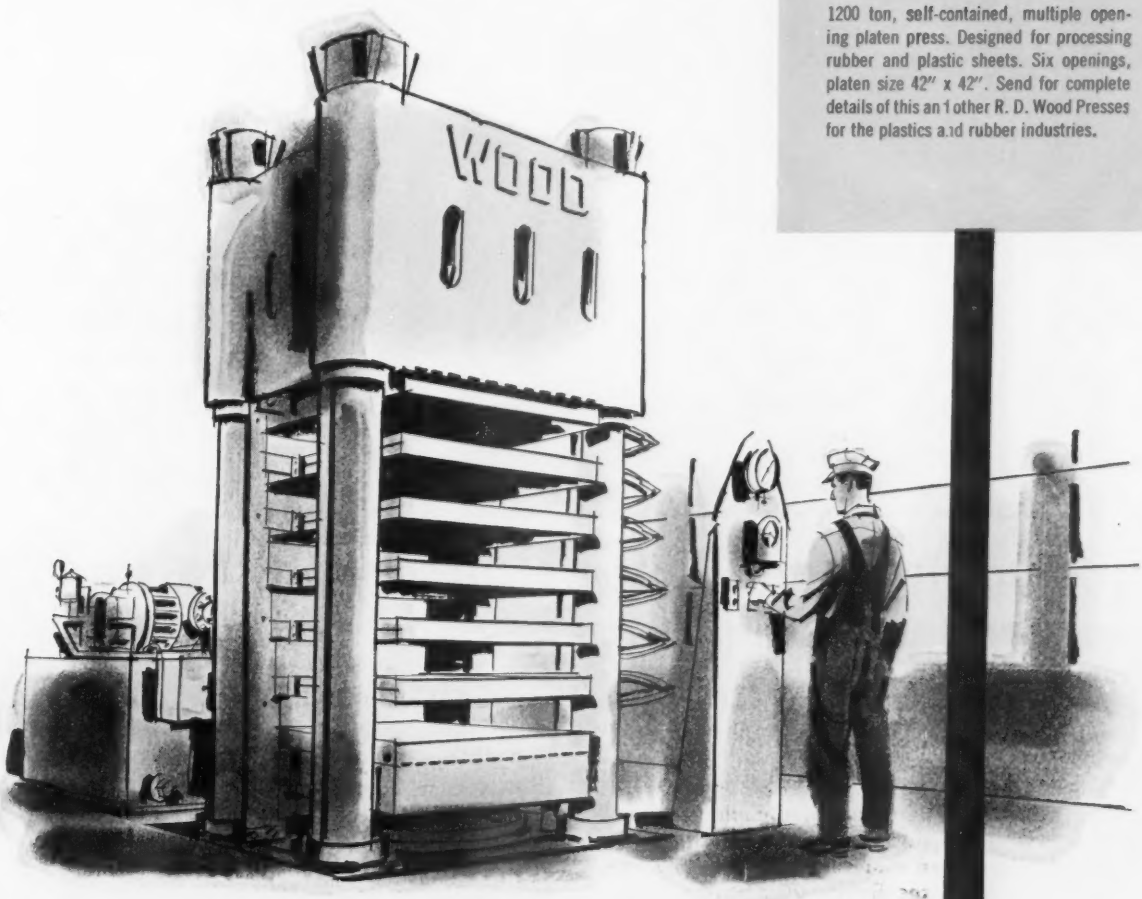

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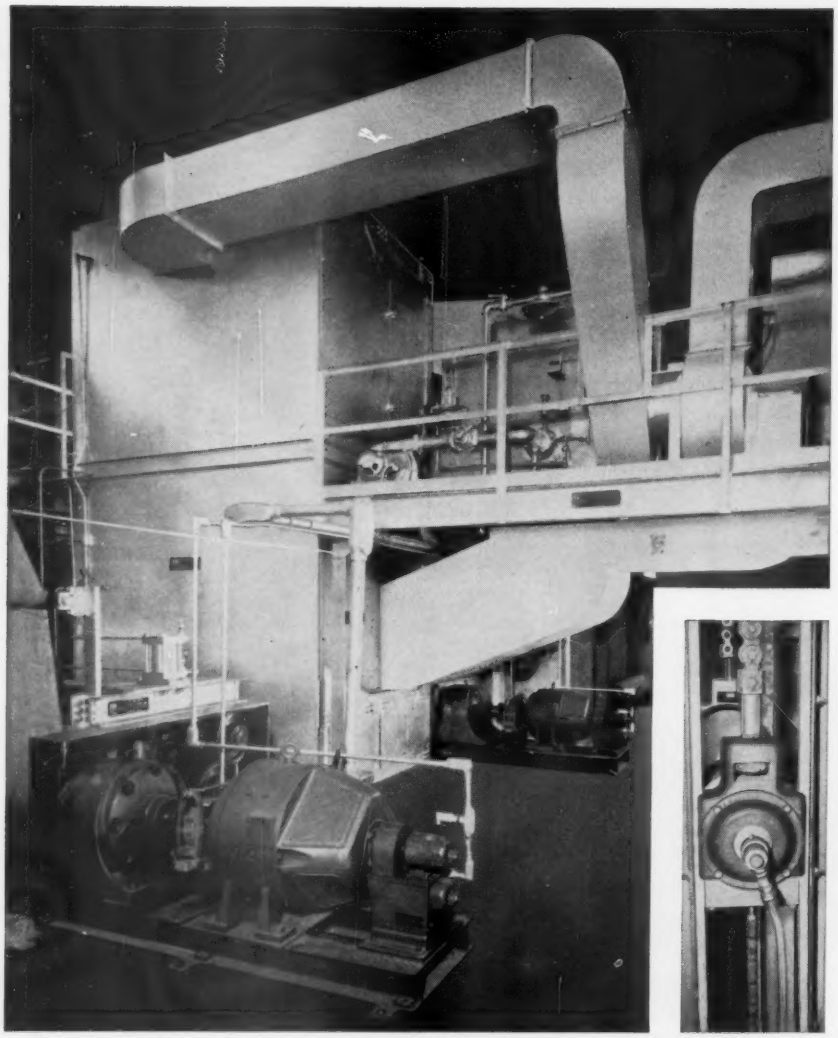

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The Rollevator® roll automatically moves up and down within the oven, in direct relation to line speeds. Thus, at *any line speed, heat-exposure* time of the nylon is held *constant* at a constant temperature setting and at constant tension.

Rollevator® Oven* hot stretches nylon tire cord at constant optimum temperature, constant time and constant tension, at variable line speeds

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AZODOX now ready for you in unlimited quantities. Priced the same as conventional zinc oxides. Available in surface treated form if desired.

Tests prove AZODOX, new form of zinc oxide (de-aerated), to be superior in all mixing operations. AZODOX incorporates readily, disperses completely in both hard and soft stocks, at high or low concentrations, on the mill or in the Banbury. Hard crust, common to pellets, is never present to cause dispersion problems. *Unlike pellets AZODOX does not consist of agglomerates.*

AZODOX is available in all grades of American process lead-free zinc oxide.

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Distributors for
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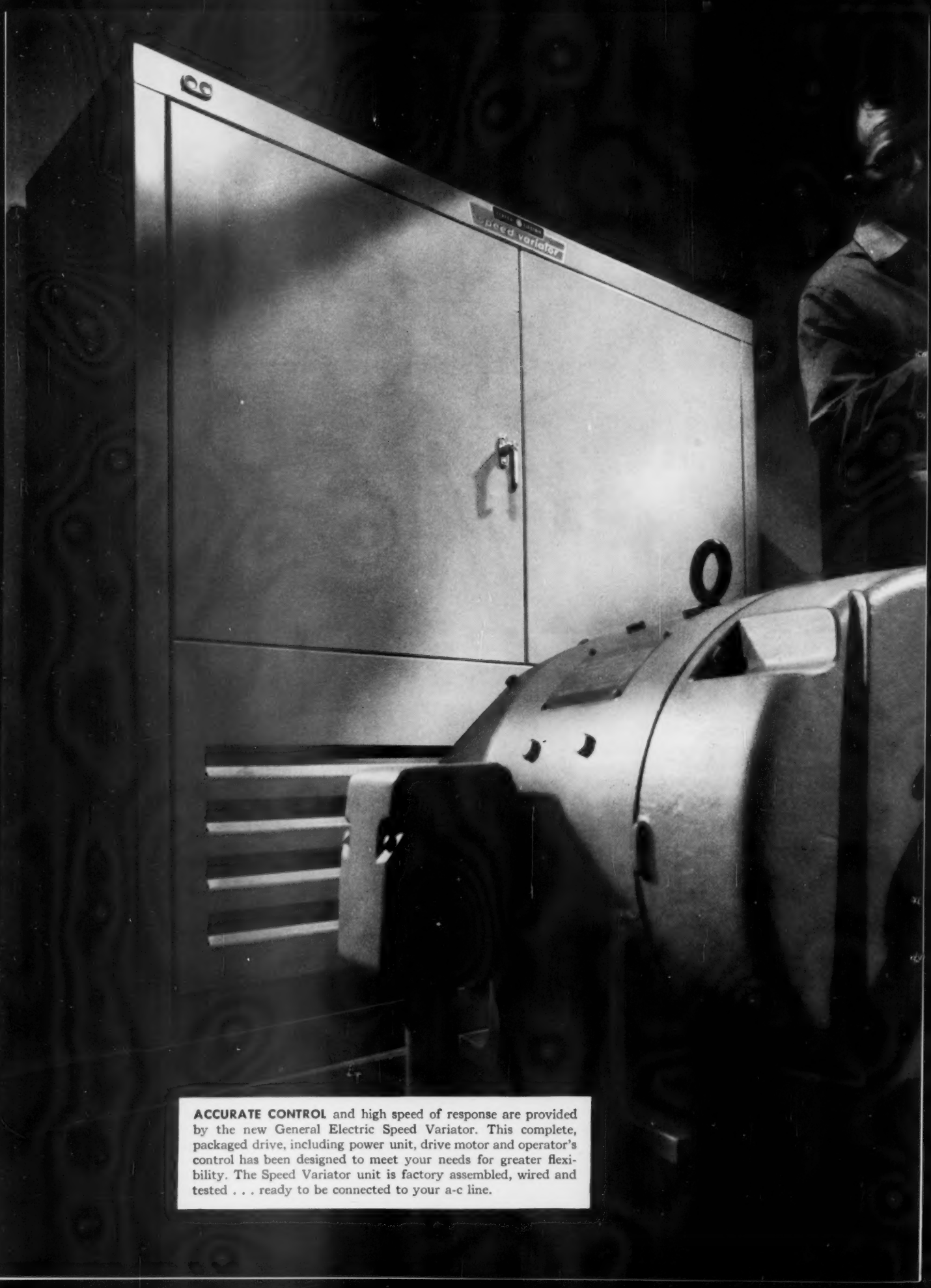


ACCURATE CONTROL and high speed of response are provided by the new General Electric Speed Variator. This complete, packaged drive, including power unit, drive motor and operator's control has been designed to meet your needs for greater flexibility. The Speed Variator unit is factory assembled, wired and tested . . . ready to be connected to your a-c line.

NEW

General Electric Speed Variator

An Adjustable-speed Drive with . . .

- Amplistat® Regulator
- Static Exciter
- Kinamatic* Drive Motors
- Silicon Rectifiers
- Two-Unit, Four-Bearing Motor-Generator Set

*Trademark of General Electric Company

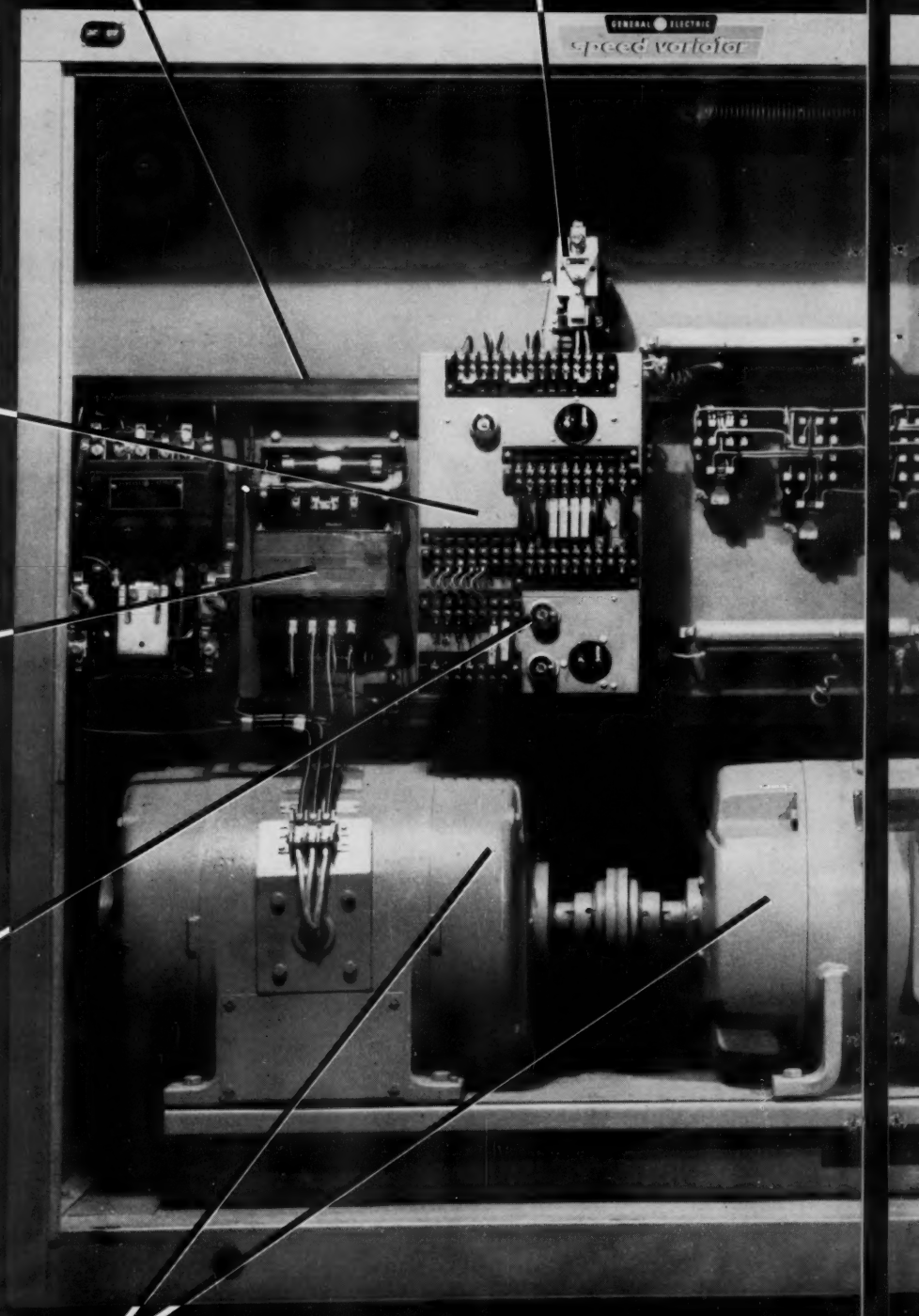
See how the new Speed Variator cuts costs

Progress Is Our Most Important Product

GENERAL ELECTRIC

RECESSED WIRING TROUGHS simplify installation and inspection. Permit back-to-back mounting of control panels when required.

FRONT-CONNECTED CONTROL COMPONENTS make servicing and replacement easy. Standard parts can be replaced from stock.



AMPLISTAT REGULATOR is standard equipment on new Speed Variator. It holds speed steady under varying loads . . . has no moving parts.

STATIC EXCITER permits immediate operation because it requires no warm-up time.

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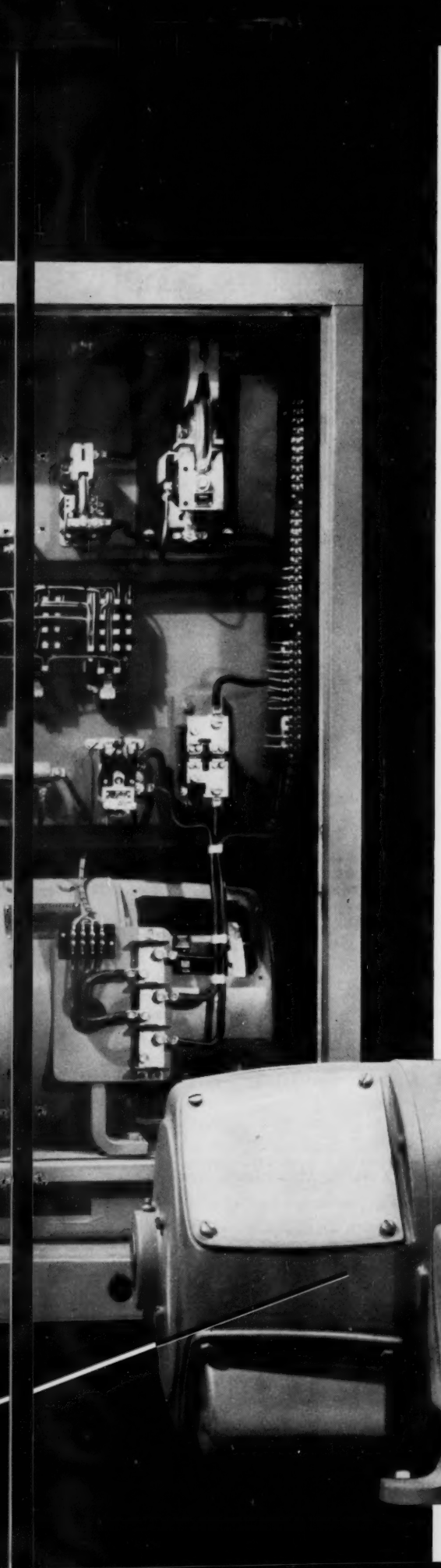

NEW

SPEED VARIATOR CUTS COSTS FOUR WAYS

1. NEW AMPLISTAT REGULATOR AND STATIC EXCITER have no moving parts. Maintenance of these components is virtually eliminated.

2. LONG-LIFE SILICON RECTIFIERS are used in both regulator and exciter. Silicon offers high standards of reliability and exceptional long-life characteristics.

3. NEW DESIGN FEATURES such as front-connected control components, color-coded wiring and recessed wiring troughs, simplify inspection and routine servicing.

4. TWO-UNIT, FOUR-BEARING MOTOR-GENERATOR SET helps reduce maintenance costs. Designed with the maintenance man in mind, terminal boards and flexible coupling simplify inspection and servicing.

May we suggest you investigate the ways the new G-E Speed Variator can help you cut costs? Please contact your nearest Apparatus Sales Office or write for GEA-6643. *Direct Current Motor and Generator Department, Erie, Pennsylvania.* 813-14

Progress Is Our Most Important Product

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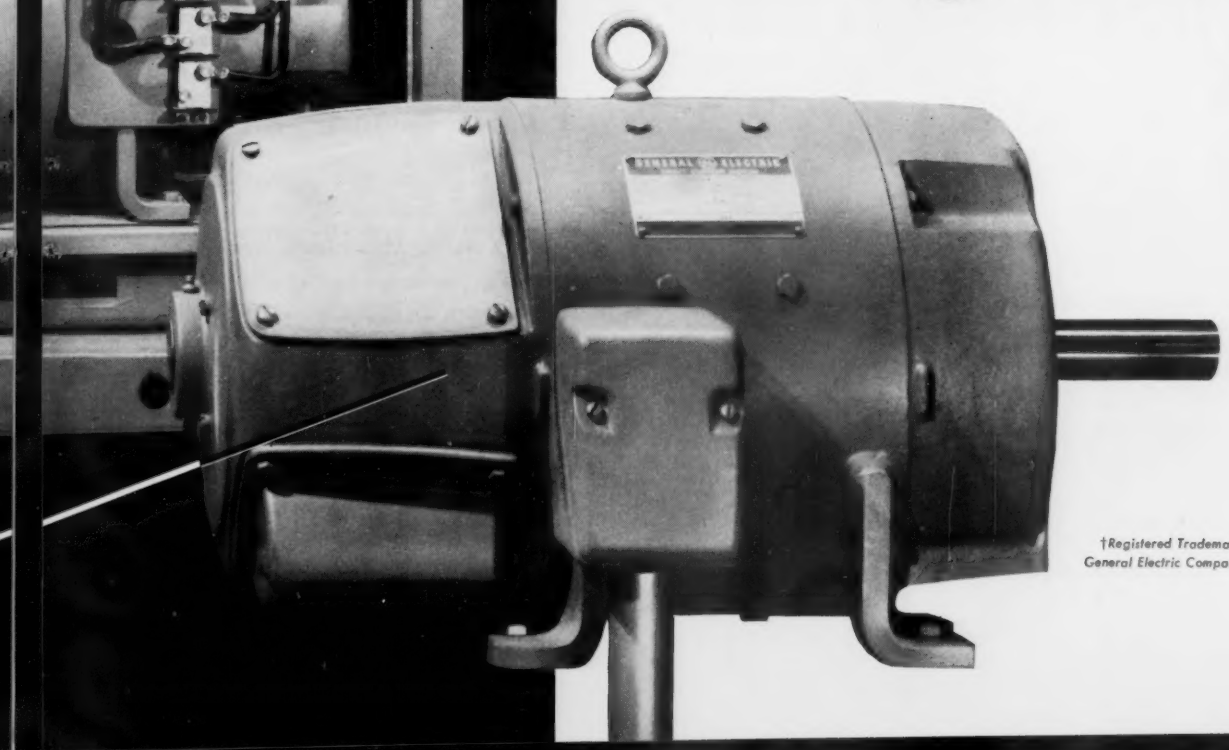

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THE CASE OF THE
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...AND UNLESS YOU CAN BEAT THIS PRODUCTION PROBLEM, WE'LL HAVE TO CANCEL YOUR CONTRACT!!
LATE SOLVENT SHIPMENTS ARE SLOWING US DOWN, BUT I'LL FIND THE ANSWER...OR A NEW PURCHASING AGENT!!
ONE MORE LATE SOLVENT SHIPMENT AND YOU'RE THROUGH, SO...
...FIND A SUPPLIER WHO CAN GET OUR SOLVENT HERE ON TIME, OR ELSE!!
PURCHASING AGENT
GOLLY, WHAT WAS THAT GUY'S NAME... LES WEBER?...YEAH!! LOGAN 1-3575... KANSAS CITY.
...AND HERE'S WHY YOU CAN QUIT WORRYING ABOUT LATE DELIVERIES WHEN YOU SWITCH TO SKELLYSOLVE!!
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LATER
THIS IS THE MAN WHO LICKED OUR PRODUCTION PROBLEM.
SMART STRATEGY, YOUNG MAN!!
HOW ABOUT EATING OUT TONIGHT? YOUR HUSBAND JUST GOT A NICE, JUICY RAISE!!
SURE GLAD I THOUGHT OF SKELLYSOLVE IN TIME!!
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SKELLYSOLVE-B. For making quick-setting cements for the shoe, tape, container, tire and other industries. Quick-drying, with no foreign taste or odor in dried compound. Closed cup flash point about −25°F.

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SKELLY Skellysolve

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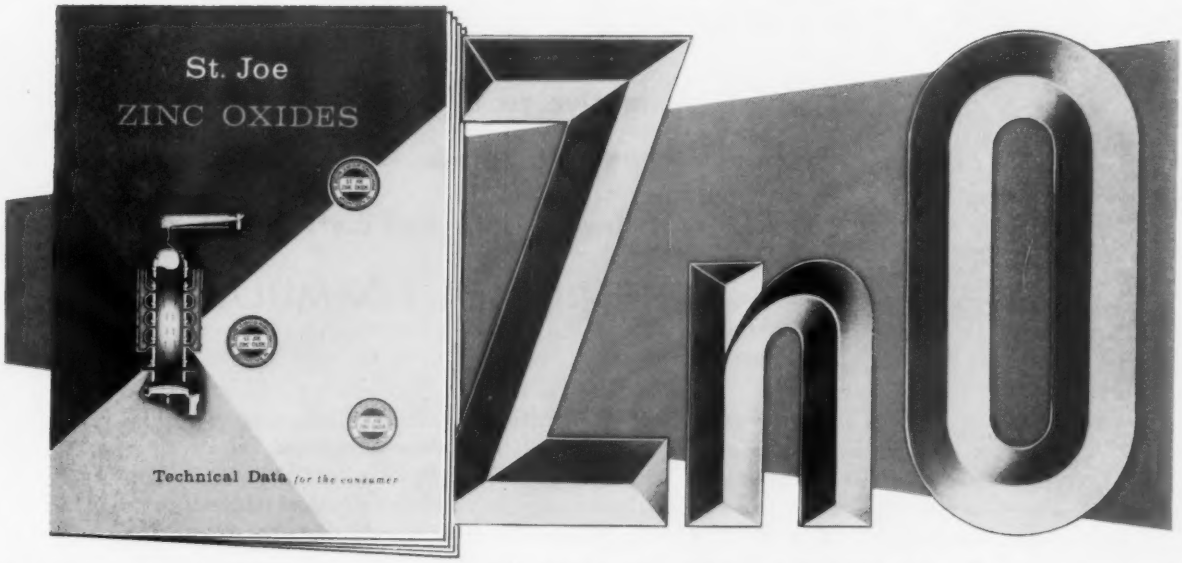
Technical Data

For Consumers Of



SECTION 1—*Production*

Preface • A Short History of the St. Joseph Lead Company • The Production of St. Joe Zinc Oxides • Mining • Milling • Roasting • Sintering • Electrothermic Smelting Process • Collecting and Packing • St. Joe Zinc Oxide Pellets • St. Joe Granular Zinc Oxide • Unit Loading of Zinc Oxide in Bags • Research and Development

SECTION 2—*Technical Data*

General Properties of Zinc Oxide • Zinc Oxide in Rubber Compounds • Tables—Fast Curing Types, Slow Curing Types, Surface Treated Types, Latex Grades • Zinc Oxide in Protective Coatings • Table—Paint Grades • Zinc Oxide in the Ceramic Industries • Table—Ceramic Grades • Zinc Oxide in Chemical, Pharmaceutical and other Industries • St. Joe Distributor Locations

ST. JOE ZINC OXIDES, a 48-page, 8½" x 11" illustrated booklet, is yours for the asking. In it we have included that information which is considered to be of maximum interest and value to the consuming industries. Because of our unique Electrothermic Process, an outline of the method by means of which we produce our lead-free, American Process zinc oxides, has also been included. As the table of contents indicates, the production aspects of ST. JOE ZINC OXIDES appear in Section 1 and supplements the technical data in Section 2 of this book.

Copies can be obtained free of charge by writing to:

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE

NEW YORK 17, N. Y.

SJ-93

Announcement

of Direct Interest to Every Manufacturer of Rubber Products (as well as suppliers of rubber chemicals and compounding ingredients)

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No single service offers any greater value to the manufacturer of rubber goods or to any laboratory or organization concerned with rubber compounds. For a period of more than ten years THE RUBBER FORMULARY has been supplying compounders with detailed practical information on almost every type of rubber compound. In a matter of minutes, the user can locate and select formulas meeting customer specifications for hardness, elongation, tensile, etc.

A great number of rubber compounds are reported in the literature and new information is constantly being added. Much of this information is difficult to come by and much of it forever remains obscure. Now, for the first time, every person having anything to do with compounds and compounding problems can have available at all times a quick and accurate reference source.

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"Of interest to anyone whose work is concerned with rubber compounds . . ."

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What Is the Formulary?

THE RUBBER FORMULARY is a monthly service cataloging rubber compounds published in technical journals and in the technical releases issued by suppliers in the rubber industry. The FORMULARY furnishes the services of recording and classifying compounding information in such a way that it is permanently available for quick reference for precise information.

How Are Compounds Recorded?

The method of recording and sorting the compounds is by the use of a punched card system. The punched card system of classifying scientific data has found wide application in recent years wherever data are collected and sorted for statistical or other systematic purposes requiring quick and easy operation. Individual filing cards are provided and each card is automatically cross-indexed.

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THE RUBBER FORMULARY is sold on an annual subscription basis (by calendar year) and is issued in a monthly shipment of cards. Each month's issue contains compounds published regularly in periodicals and technical releases of suppliers to the rubber industry. Each shipment is accompanied by a table of contents (in loose-leaf form) listing the compounds and their source.

What Compounds Are Included?

THE RUBBER FORMULARY includes elastomer compounds taken from articles published in principal American and British technical journals. Polyvinyl formulations are included as well as those based on natural and synthetic rubbers. Tensile at break, elongation at break, and hardness are reported either as figures or graphically as points representing measured values.

How Many Compounds Are Issued?

Judging from the number of compounds published in journals and technical releases during the past years, it is expected that THE RUBBER FORMULARY will provide subscribers with 700 to 1,000 cards a year. For example, THE RUBBER FORMULARY for 1948 contained 693 compounds; for 1949, 977 compounds; for 1950, 759 compounds; for 1952, 842 compounds, and 838 in 1955.

How Are Compounds Classified?

Holes and imprints on the edge of each card serve for the classification and indexing of each compound. They are so designed that each compound is classified according to the principal physical properties, according to the type of rubber hydrocarbon, and as to whether or not the compound contains carbon black. Additional space is provided so that the user can add his own notes.

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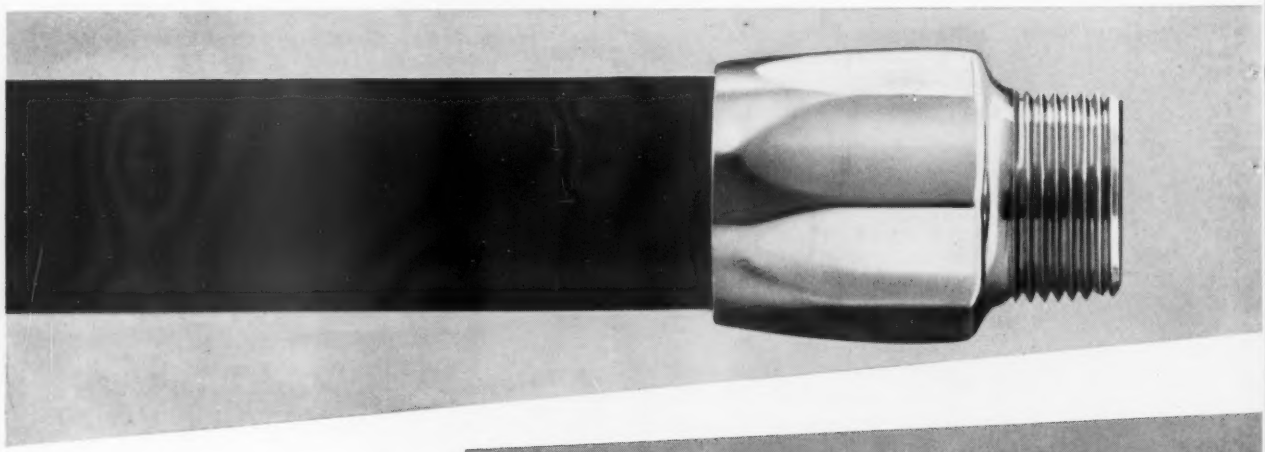
ANNOUNCING

the development by Scovill of the **FIRST**



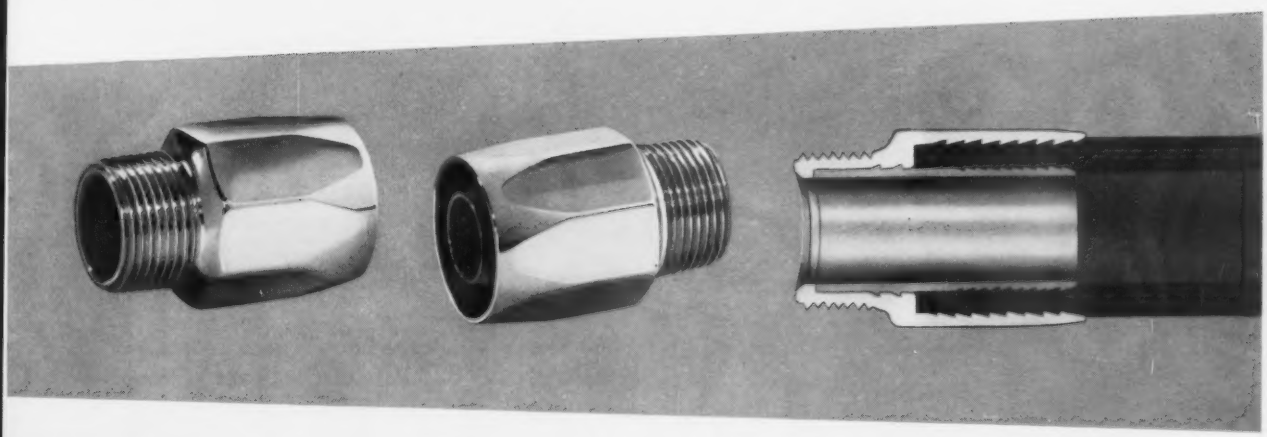
Permanently-attached—like all Scovill permanently-attached couplings, the aluminum coupling provides maximum safety and full flow.

20% LESS IN COST!

(33⅓ less than reattachables!)

ALUMINUM COUPLING
for gasoline pump hose

Lighter in weight—one third the weight of brass permanently-attached couplings, the aluminum coupling costs less to handle and to ship.



The product of more than 5 years of Scovill research and engineering, this all-aluminum coupling for gasoline pump hose is identical in performance to brass in all respects. You can be sure of the same precision fit, full flow, leakproof safety, positive static connection and long life for which all Scovill permanently-attached couplings are recognized and respected—and **all at far less cost!** The saving is even more attractive when compared with reattachable-type couplings.

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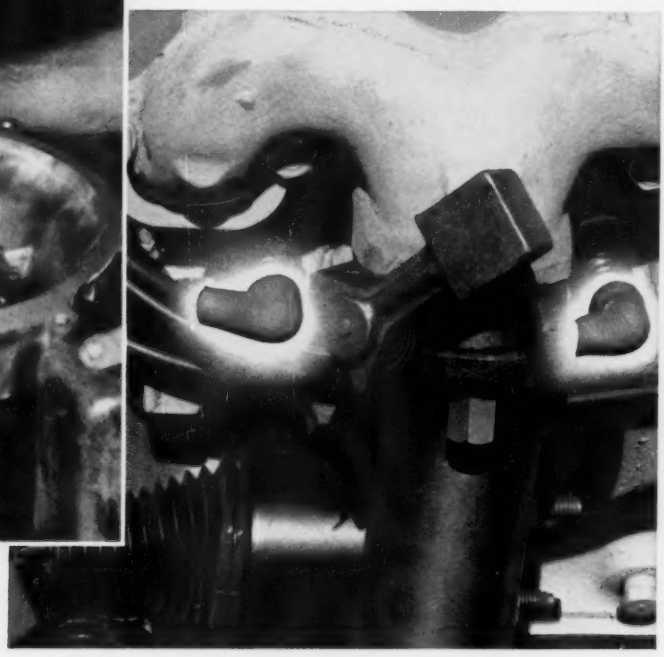
Automotive transmission seals and spark plug covers withstand heat and provide long lasting resistance to hot oils and moisture when molded from stocks compounded with Silastic 432 Base.



SILASTIC 432 Base

speeds processing of stocks for molded parts

TYPICAL PROPERTIES OF
MOLDED PARTS
MADE WITH SILASTIC 432 BASE

Temperature range, F.	−100 to +500
Tensile strength, psi	800
Elongation, %	260
Tear strength, ppi	70
Compression set, %	25
Hardness, Durometer	50

All properties obtained on ASTM slabs molded 5 minutes at 260 F and cured 8 hours at 480 F.

You can compound stocks with *superior physical properties* easier and faster with Silastic* 432 Base than with any silicone rubber gum. This unique Dow Corning compounding base needs no toxic additives for low compression set, requires no bin aging after compounding and has excellent shelf life. Most important, parts molded from stocks compounded with 432 Base show remarkable resistance to heat, cold, moisture and certain hot oils.

Do you want the recipe? *Complete instructions on the compounding of stocks for better molded parts using Silastic 432 Base plus other custom formulations are obtainable at any Dow Corning branch office. Just ask . . . no obligation.*

FREE SAMPLE *Try Silastic 432 Base in your own plant. Write Today. Address Dept. 921*

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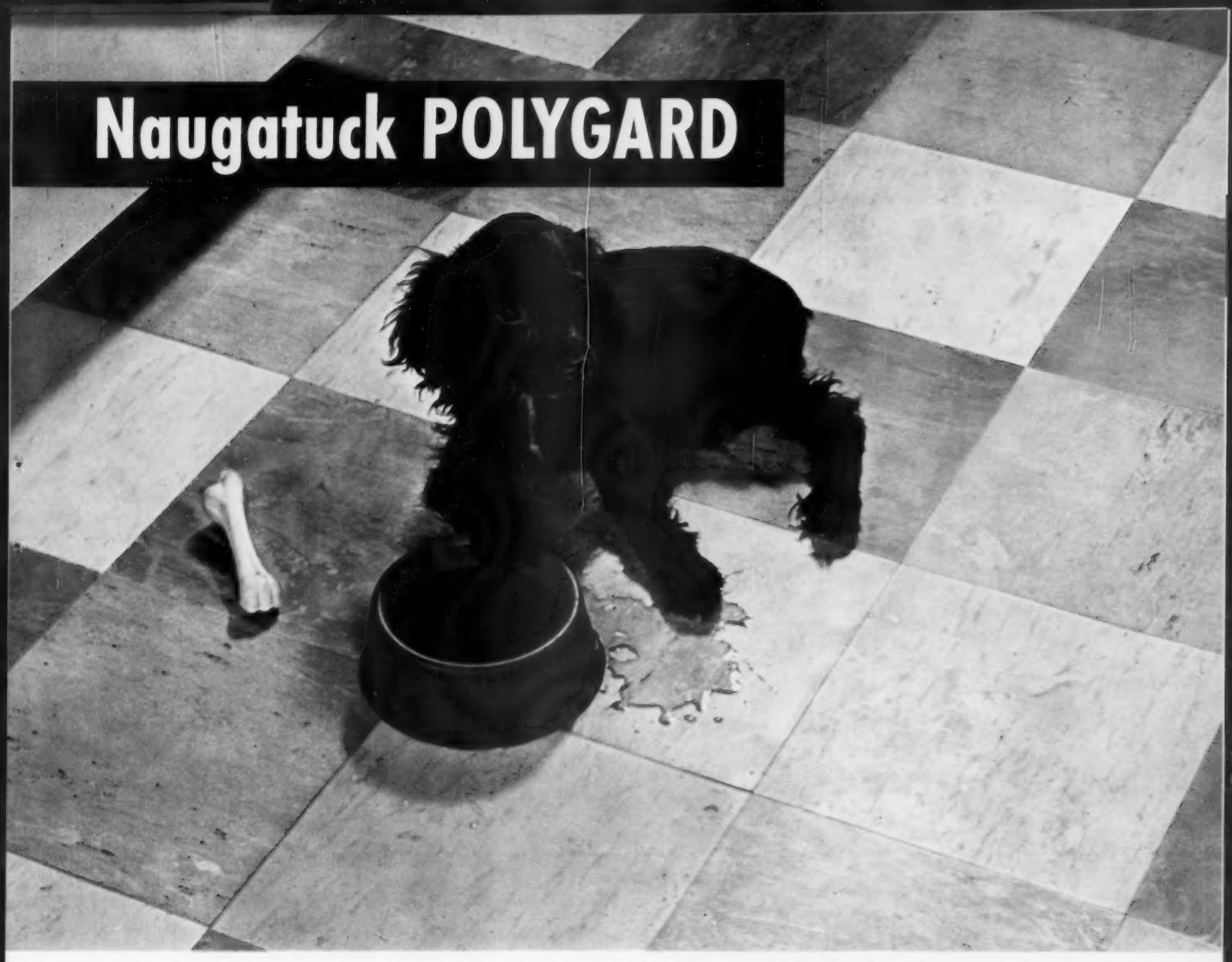
MIDLAND, MICHIGAN

Naugatuck POLYGARD



makes these permanent COLORS possible!

Bright and pastel colors and pure whites are opening new and bigger markets for rubber products like these. A prerequisite to these permanent colors is a well-stabilized, non-discoloring and non-staining rubber polymer.

Polygard's excellent stabilizing and non-discoloring properties combined in such a polymer are insurance for producing such bright-colored end products as shown here.

Join the big Color Parade to new and bigger markets. Use only Polygard®-stabilized polymers.

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The oil-resistant, ozone-resistant nitrile rubber

Now! lasting COLORS in rubber wire jackets

A development of Naugatuck research makes it possible to combine in a vulcanized rubber wire jacket all these properties:

- Excellent resistance to ozone and outdoor "weathering"
- Outstanding heat resistance
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- Excellent oil, grease and chemical resistance
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...**PLUS PERMANENT BRIGHT COLORS**

In addition to the suggested uses, you will think of dozens of other applications where wire jacketing with all these properties can serve either an aesthetic or utilitarian purpose.

One of Naugatuck's technical representatives will be happy to discuss with any prospective user the formulation of the Paracril® Ozo compound which makes possible this combination of properties... not only in wire jacketing but also in shoe soles, hose jackets, weather stripping and other vulcanized rubber products.

Naugatuck Chemical

Division of United States Rubber Company, Naugatuck, Connecticut

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review & preview

OF THE RUBBER INDUSTRY

An editorial appraisal of the rubber industry and comments by industry leaders written expressly for the readers of RUBBER AGE

Editors' Round-up

The General Economy

When December of 1958 rolls around we will likely find that 1958 matched 1957 in most respects and we will probably find that 1958 has been a better year than expected by many at this point.

► If the key to the 1957 economy was "cautious optimism," the prevailing mood for the general economy in 1958 can best be described as "hopeful pessimism." Where the rubber industry is concerned, however, we prefer to apply the term "calculated confidence." The reasoning behind this preference will be spelled out in detail later.

Although there is a wide divergence of opinion, most economists are agreed that so far as the general economy is concerned, some downturn in business conditions will occur during 1958—at least in the first half of the year. The question seems to hinge, however, on the degree and, more importantly, on what the final outcome is likely to be.

According to the Director of Economic Research for the U. S. Chamber of Commerce, "an optimist these days is one who thinks that 1958 is going to be as good a business year as 1957." He added that there are signs that suggest "we are in for something more than minor adjustments" in the months ahead. Unemployment is growing and is likely to continue to do so. It is possible that the slide could pull down the Gross National Product—estimated at $439 billion for 1957—by $3 billion to $5 billion before an upturn comes.

Slump of Short Duration

Other Chamber members, however, are not nearly so pessimistic, predicting the current business slump will be of short duration. It is thought that accelerated defense spending, such as the recently approved $200 million contract for development of a new jet bomber, will be a stimulant to the economy. Also to be noted is the fact that Congress has already released some $177 million in housing money. The head of the Chamber's Economic Policy Committee puts it this way: "While a balanced budget is highly desirable . . . it should not be a fetish if national security would be threatened . . . or economic growth inhibited."

A composite assessment of the general economic picture for 1958 as seen by the Chamber reveals these sentiments:

- Production and sales at or near 1957 levels.
- Prices likely to go up.
- Profits down, caught between rising costs and softer sales.
- A late autumn upturn that will likely make up for a less satisfying first half.

While all the organizations which concern themselves with the economic life of our country apparently start with much the same figures, the interpretations based upon these figures vary. A recent survey of over 1,600 business executives found that despite reports of sluggish economic activity in some lines, businessmen are generally looking forward to 1958 as a year of continued high business activity, both for their own companies and for the national economy.

Almost one-third of the executives interviewed expected narrowing profit margins to be their outstanding problem, but about eight out of ten anticipated that 1958 profits would be equal to or will exceed those of 1957. Manufacturers were slightly more optimistic than either retailers or wholesalers.

Many hope to achieve an increase in profits through expansion. Of those reporting on 1958 plans, 23 per cent were most interested in adding to their facilities and their product lines; 13 per cent hoped to concentrate primarily on the improving sales through better merchandising and more extensive advertising. Only one per cent had any idea of cutting down production and somewhat more than 30 per cent reported no definite plans.

Collections Problem Expected

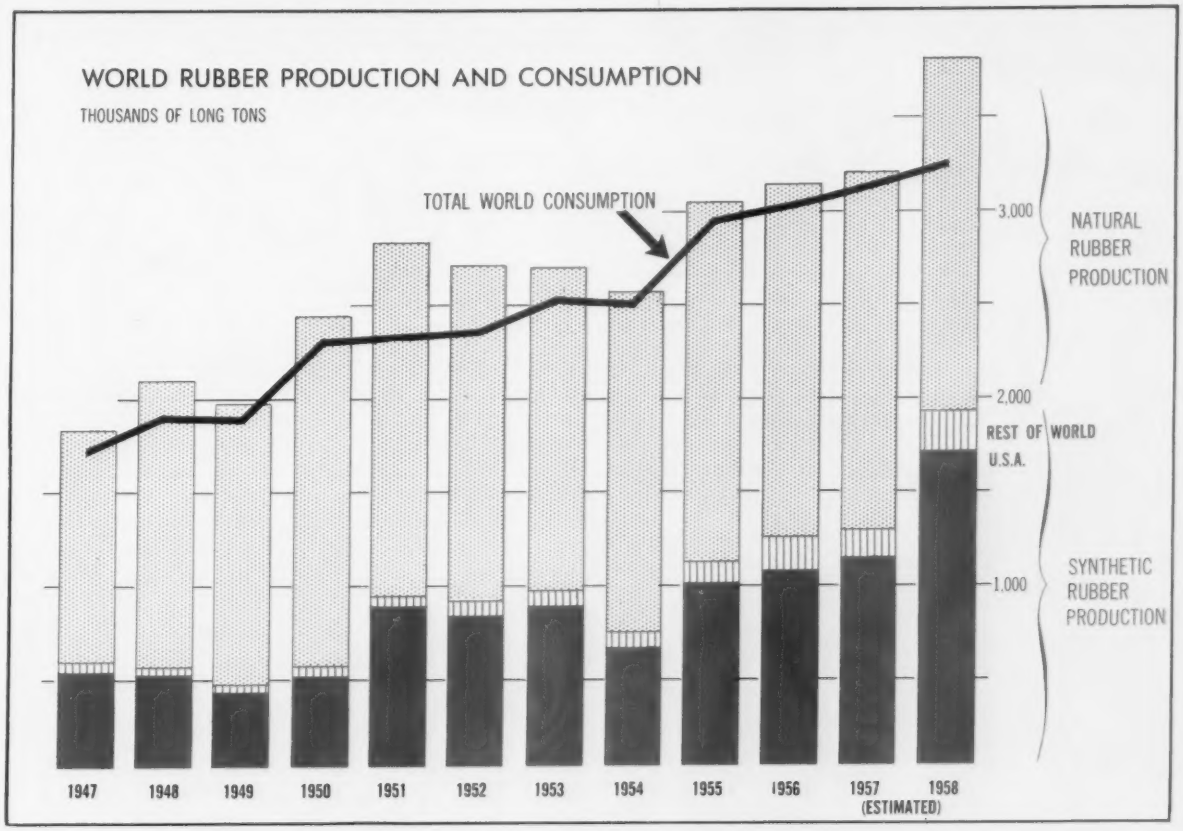
About eight per cent of those interviewed expected collections to be their principal problem in 1958, and the two per cent anticipated problems in financing their operations. Roughly ten per cent foresaw no special problems for 1958.

As an interesting footnote, most executives questioned were somewhat more optimistic about 1958 prospects for their own businesses than they were for the nation as a whole.

Other sidelights have been added by economists of a leading insurance company who see this picture for 1958:

- Business capital expenditures down $3 billion from 1957.
- Home buying up $1 billion.
- Consumer spending rising by $11 billion.
- Government spending, on all levels, rising by $11 billion.

John D. Wilson, vice-president of the Chase Manhattan Bank of New York, and an outstanding economist, speaking at the recent annual meeting of the Rubber Manufacturers Association in New York, observed that during the past few months many persons and organizations have been predicting a decline in capital spending in 1958. The reason for this expectation lies in the growing evidence that producers in some lines might have been building too fast—that excess capacity was beginning to accumulate. Actually, the United States—and indeed the whole Western World—has been undergoing a prolonged investment boom in the post-war period.



During this time, U. S. productive capacity for all forms of goods has grown by close to 50 per cent. The expansion has been particularly rapid in the broad field of manufacturing, Mr. Wilson stated.

Following World War II and continuing up through 1952, both manufacturing capacity and manufacturing output increased at an average rate of approximately six per cent per year, the latter particularly spurred on in the initial period by shortages borne out of the war and later by the Korean conflict. Since 1953, however, capacity has continued to expand about six per cent a year but the growth of production has been considerably less. Manufacturing production in 1957, as measured by the Federal Reserve Board Index, has been a little higher than the peak reached in late 1955.

The result has been a substantial increase in "excess" capacity, viz., there is a greater capacity to produce than estimated consumption warrants. American industry, however, needs some excess capacity—both to operate efficiently and to meet peak demands that do not hit all lines at the same time. Surveys taken in the past suggest that industry as a whole prefers to operate in a range that centers around 90 per cent of capacity. Yet, as recently as September, 1957, manufacturers were producing no more than 82 per cent of capacity.

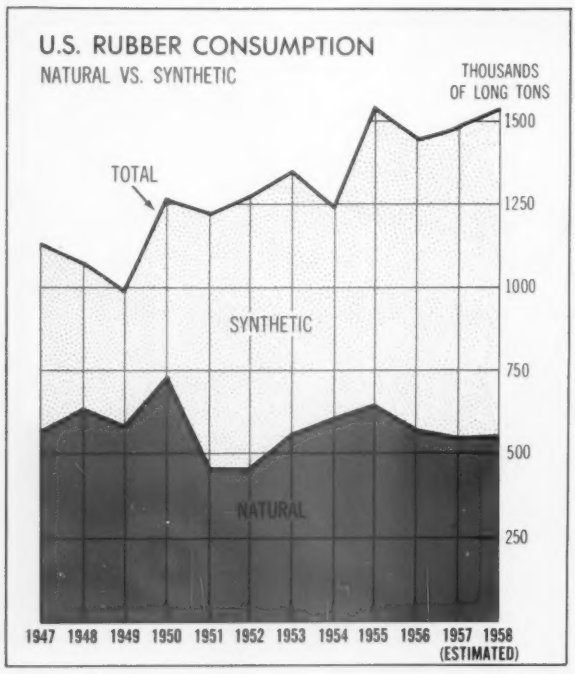
It would seem, in total, that a "bearish" sentiment now predominates. There are, however, several paradoxes. Even the "bears" who are most firm in their opinions expect a marked pick-up in the second half of 1958. They believe that the somewhat gentle recession we are now witnessing will turn into a healthy revival during the last half of 1958. When December of 1958 rolls around, we will likely find that 1958 matched 1957 in most respects and we will probably find that 1958 has been a better year than expected by many at this point.

The Rubber Industry

The rubber industry, by virtue of its estimated consumption and planned capital expenditures, is exhibiting a great deal of faith in the future.

In any discussion of the economic condition of the rubber industry, the first subject on the agenda must be new rubber consumption. Estimates for 1957 indicate world consumption of 3,140,000 long tons, which compares with 3,025,000 long tons in 1956 and 2,980,000 long tons in 1955. It is our belief that world consumption of new rubber in 1958 will rise to 3,250,000 long tons, as shown in the bar graph above.

As for the United States, according to estimates made by the government and such independent agencies as the Statistical Committee of the Rubber Manufacturers As-



sociation, consumption of new rubber in the United States in 1957 totaled 1,475,000 long tons, compared with 1,436,482 long tons in 1956 and 1,529,699 long tons in 1955, a record year. The 1957 consumption consisted of 544,000 long tons of natural and 931,000 long tons of synthetic. This indicates approximately 36.7 per cent of natural and 63.3 per cent of synthetic rubber.

We estimate that in 1958 the United States will consume about 1,520,000 long tons of new rubber, including 548,000 long tons of natural and 972,000 long tons of synthetic rubber (see illustration above). The consumption pattern of new rubber in the United States has been indicating an ever-widening gap between synthetic and natural rubber. In 1958, about 64 per cent of the new rubber consumed in the United States will be synthetic while the balance will be natural. Of course, the ratio is subject to change if, for example, the price of natural rubber rises or falls to any appreciable degree. As far as reclaimed rubber is concerned. It is now estimated that some 270,000 long tons were consumed in 1957. Consumption of reclaimed rubber in 1958 will be at or near that mark.

Large Synthetic Capacity

Where synthetic rubber is concerned, we are now faced with what some may call an "overabundance of riches." As previously noted, our total consumption of new rubber in the United States in 1958 is expected to be in the order of 1,520,000 long tons. We also note that this country now has the capacity to produce about 1,666,000 long tons of all types of synthetic rubber. It is thus seen that this country has the capacity to produce more synthetic rubber than total estimated consumption of new rubber in 1958.

Obviously, we will continue our consumption of natural rubber. Natural rubber still suits some purposes which synthetic rubber does not. The recent chemical advances in synthetic rubbers which duplicate or exceed the technical competence of natural are not too great a factor at this point because of questions of price and the lack of plant capacity.

The actual production of synthetic rubber in 1958 will probably be at or near the figure for 1957, that is, about 1,255,000 long tons. We have already estimated that the United States will consume about 972,000 long tons of synthetic rubber in 1958. This consumption figure will leave close to 280,000 long tons of synthetic rubber unaccounted for. The answer comes in exports. Exports of synthetic rubber from the United States have been growing during the past few years and they can be expected to do so at least until that time when new synthetic rubber producing facilities in England, France, Germany, Italy and elsewhere come into being. These new facilities are expected to produce some 100,000 long tons a year in total.

For example, a butadiene-styrene synthetic rubber plant is now being constructed in England with an annual capacity of about 50,000 long tons. Italy is constructing a 15,000 long ton unit while France is working on a butyl plant and West Germany is constructing still another butadiene-styrene facility. England has two special purpose synthetic plants in production, including a nitrile rubber facility. A neoprene unit in Scotland is nearing completion.

Foreign Synthetic Consumption

An interesting factor to consider at this point is the rising consumption of synthetic rubber abroad. Statistics of the International Rubber Study Group indicate that synthetic rubber in the Free World accounted for 6.7 per cent of new rubber consumption in 1954, 10.8 per cent in 1955, and about 16.2 per cent in 1956. It may very well be that in 1958 the consumption of synthetic rubber in the Free World will account for some 20 per cent of its total new rubber consumption.

On the face of it, the future does not look too promising for natural rubber. Production of natural is not expected to grow by any appreciable amount in the immediate future. Any substantial increases in natural rubber production will come from increased yields and these increases will not make any great impact on the 1958 picture. It is estimated that some 1,888,000 long tons of natural rubber were produced in 1957. It is predicted that about 1,900,000 long tons will be produced in 1958 and by 1965 this figure is expected to increase to 2,035,000 long tons.

What must be taken into account is the fact that per capita consumption of new rubber throughout the world is on the increase even when such matters as population growth are considered. In 1956, per capita consumption of new rubber in the United States was 19.1 pounds while the rest of the world showed a 1.4 pound consumption per person. The world average per capita consumption was 2.5 pounds. It can reasonably be expected that in 1958 the world average will be slightly higher and by 1965 the average should rise to close to 3.3 pounds. With these figures in mind, the likelihood exists that a market may exist for all the natural rubber which will

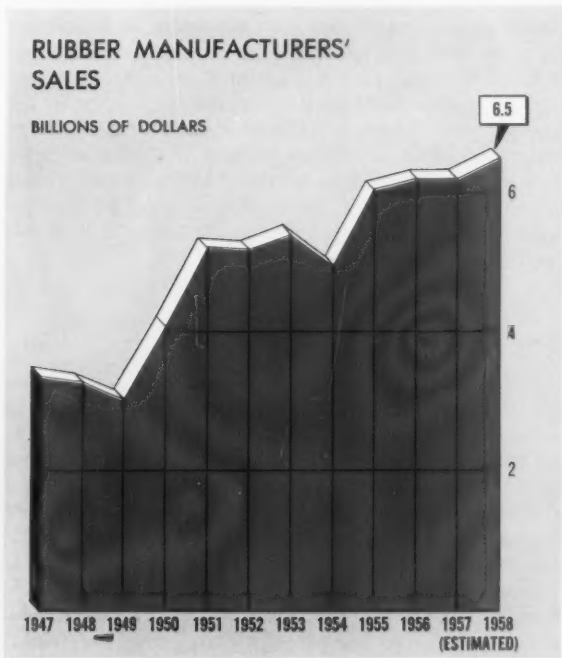
be produced at that time (1965), even with added synthetic capacity.

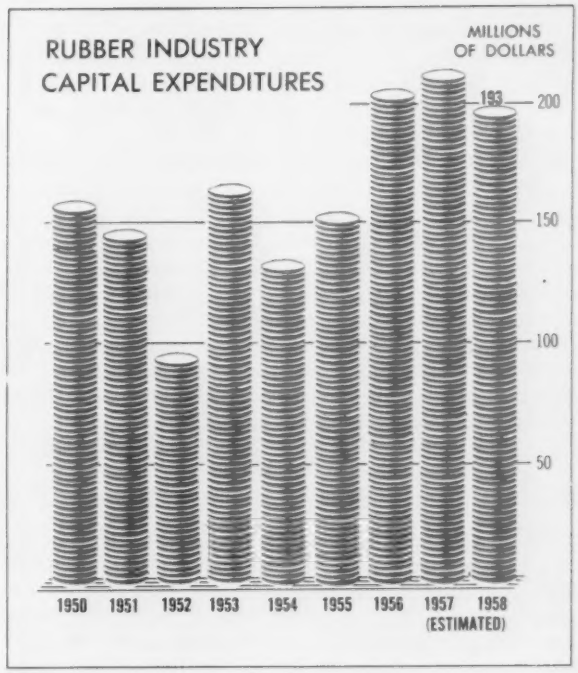
One further note with reference to natural rubber should be mentioned, and that is the natural rubber stockpile in the United States which is now estimated to total some 1,200,000 long tons. This quantity of rubber, readily available for use, cannot but exert a good deal of pressure on the market. From time-to-time, persons and organizations in the industry have asked for some official change in policy to reduce the stockpile. The thought here is that in the event of an emergency, the United States could supply its every technological need with synthetic rubbers and particularly with the natural-like synthetics.

Because of the political and military ramifications, it is doubtful if radical changes in stockpile procedure will be forthcoming in the next one or two years. Within the next few years, however, the natural-like synthetics may be produced in volume and at costs which will not prohibit their wide use. In this light, the stockpile could conceivably be considered as a casualty of advancing technology.

Whatever the problems which beset rubber—both natural and synthetic—we can take comfort in the fact that our difficulties do not involve shortages of raw materials. The fact that we do have a plentitude of raw materials, on the other hand, does much to dictate a stable price picture in the months and years that lie ahead.

This matter of stability is borne out by other industry facts. Of the twenty-three major industry groups in the United States, the rubber industry in 1956 ranked fifteenth in its relation of profits to capital investment with an average profit of 9 per cent compared with ten per cent for all industry. In terms of sales, we now reckon our industry to be approaching the $6.5 billion mark per year, as shown below. Net profits in 1958, after taxes, will be at or near the $300 million mark.





A good guide to the industry's feelings about itself is usually indicated by the capital expenditures planned. The rubber industry, since World War II, has been investing a goodly percentage of its gross plant in capital expenditures. Currently available figures show that the rubber industry made capital investments of some $208 million in 1957. It is estimated that the industry will invest some $193 million in 1958, or seven per cent less than in the previous year. (See chart above).

The estimated figure for 1958 is remarkable indeed when one considers that the major capital investments for 1957 were for additional or modernized synthetic rubber producing facilities. 1958 will not see the addition of many new polymer or copolymer plants—in fact this phase of industry operations should be rather quiet for the next year or two in view of the productive capacity now available. There will, of course, be some investment for new or improved polymers. With the major expense of copolymer facilities out of the way, the rubber industry would seem to be exhibiting a great deal of faith in its future by its planned investments in finished product capacity for 1958.

The Transportation Segment

Strong replacement passenger tire sales will make 1958 one of the best years in the history of the tire industry.

The tire companies all enjoyed sales increases in 1957, reflecting high automobile production and strong replacement demand. However, profit margins have tended to

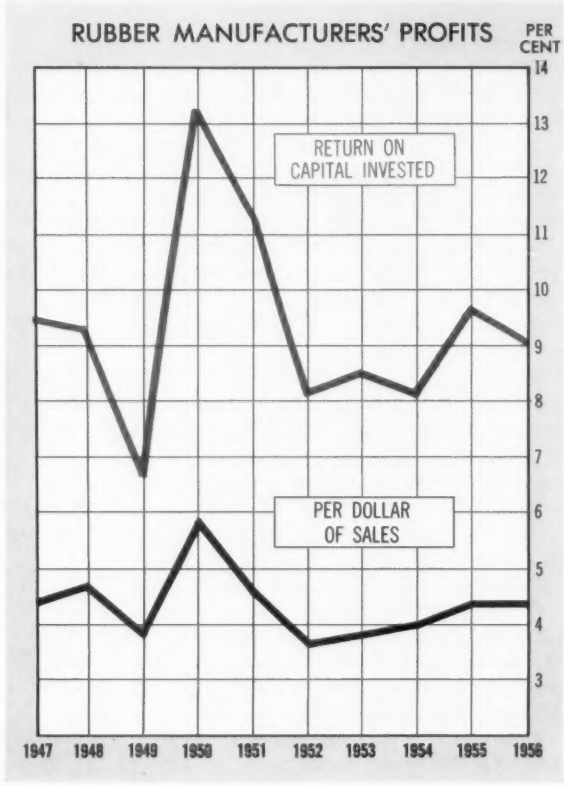
weaken for some of the companies. According to the most knowledgeable estimates, still lower profit spreads appear likely in 1958 because of continued rising prices for raw materials and labor. The illustrations which appear on these pages depict some interesting facts with reference to rubber manufacturers' profits in the last year for which complete figures are available—1956.

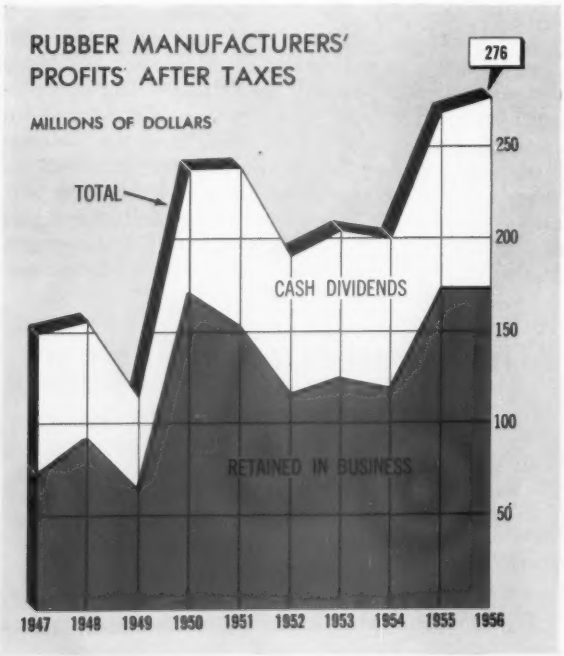
Automobile output in 1958 is projected at close to 6 million cars in comparison with 1957's close to 6.2 million cars produced. Accordingly, the demand for original equipment tires may slide by a million units. While the dual chambered tires pose no threat to the 1958 picture, the coming years may see their general adoption. Tires of this type will, in many cases, do away with the need for the spare tire. It is not inconceivable, therefore, that by 1960 the number of tires required in the original equipment market will drop even more.

Replacement Tires A Mainstay

More than ever, replacement tires will again be the mainstay of the tire market in 1958. The number of automobiles in use keeps increasing. In 1957, for example, motor vehicle registrations in the United States reached an estimated 67,231,000 units. Another factor is that motor vehicle travel in the United States has almost doubled in the past ten years. In 1956, the American people spent nearly ten per cent of their disposable income to operate their cars. With these background matters in hand, it is estimated that total tire sales in 1958 will reach about 112,730,000 units compared with 110,530,000 in 1957 and the all-time high of 114,244,000 established in 1955.

While 1958 may thus turn out to be the second best year in the history of the tire industry, it is acknowledged that some "soft" spots are evident. Prices will likely be under pressure. Consumer apathy, at least in the first few months of the year, may be a troublesome factor. Prices on replacement tires, retailed through myriad channels, under a complex system of discounts and grades, are vulnerable.

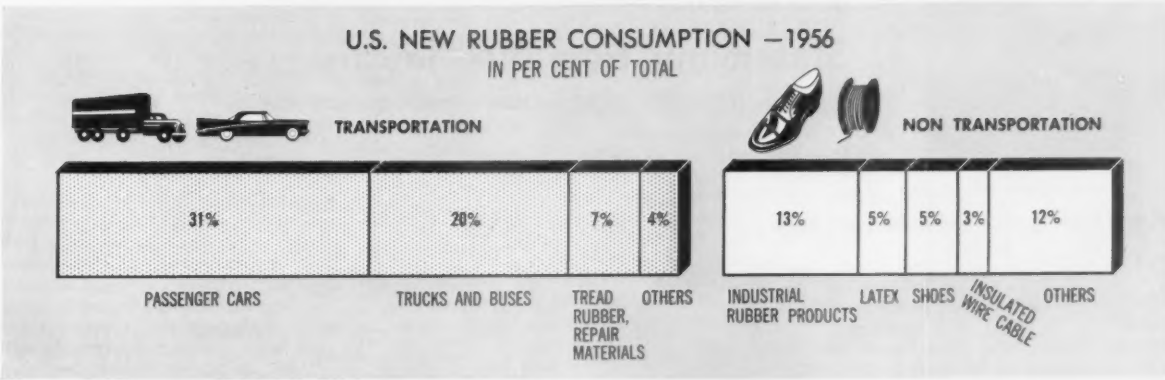




Some in the trade see cause for alarm in the inventory picture. It is reported that tire inventories were building up in the latter part of 1957. By the end of September, inventories totaled 19.4 million units, ten per cent above the 17.6 million units on hand at the same point in the previous year. There is really no cause for alarm, however. Inventories are higher because the tire distributor must now keep stocks of tubed as well as tubeless tires on hand. In addition, he must keep on hand nylon, rayon and high tenacity rayon cord tires as well as 14- and 15-inch sizes.

Strong Year Foreseen

In balance, then, we see a strong year for the tire industry with replacement sales more than compensating for any deficiencies in original equipment demand. The fact that replacement tires are assuming an even more significant position is probably all to the good as it is a generally recognized fact that from the point of view of profit margins, replacement tire sales are more desirable than original equipment sales. In addition, tire manufacturers are looking to increased truck tire sales in 1958, making up ground lost in the previous year when sales of this type of tire fell off somewhat.



The Non-Transportation Segment

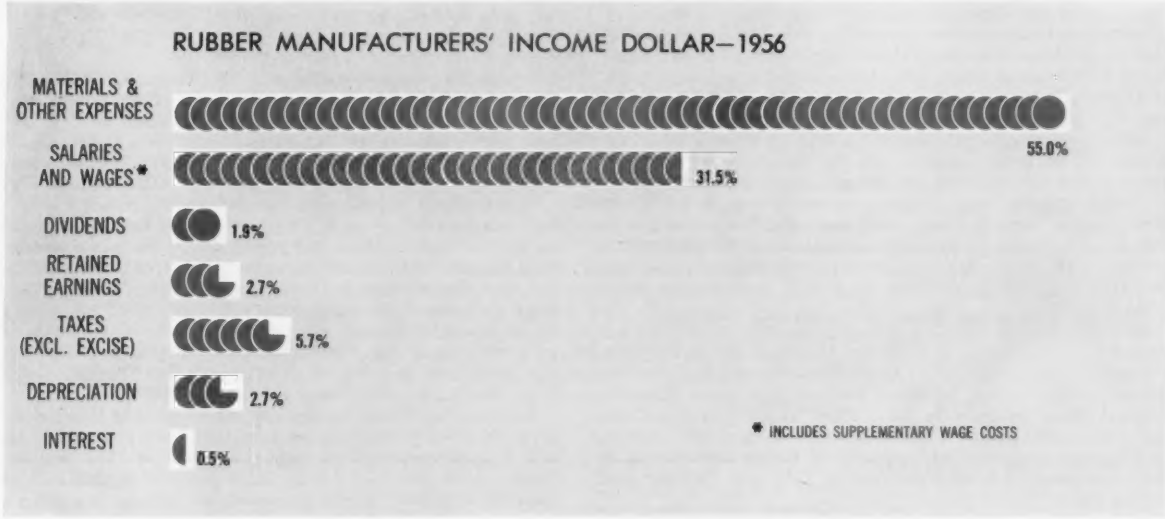
The Non-Transportation Segment Looks For An Even Greater Share of Industry Sales

The non-transportation segment of the rubber industry is expected to consume about 582,000 long tons of new rubber in 1958, about 38 per cent of total consumption in the United States. The chart above shows how new rubber was consumed in 1956. The dollar sales volume of non-tire products already exceeds that of the transportation segment and should continue to grow at a faster rate as a result of the development of many new products and increased usage of such standard non-tire items as conveyor belting, foam rubber, hose, floor covering, etc.

This industry segment will account for something like 54 per cent of total rubber industry sales in 1958. There can be little doubt that this segment of the industry is on the ascendency when one examines the picture which has been developing over the past few years. In 1951, for example, sales of non-tire products had already risen to 51 per cent of the total. By comparison, in 1937, non-tire products accounted for only 41 per cent of total sales. The gains in this industry segment have been truly remarkable and bid fair to continue to be so.

Not too much glee is being expressed about the profit picture, however, with some producers complaining about the low margins under which they are forced to operate. During the past few years, producers of non-tire products, particularly mechanical goods, have been investing a great deal of money in plant modernization and expansion, and many believe that the returns have not been equal to the expenditures. Some producers in this segment are said to be operating on a margin of one per cent profit after taxes and still others average only 3 per cent.

An economic dip of even short duration may cause difficulties for a number of mechanical goods producers. It must be said, however, that the mechanical goods field is the one part of the industry which has been making the greatest technological strides in recent years. The growth potential of this segment of the rubber industry would seem to be very great indeed. It is our opinion that the mechanical goods producers and the non-transportation segment as a whole will experience a highly satisfactory year in 1958.



Statements from the Industry

Another Record Year in 1958 . . .

H. S. FIRESTONE, JR.

PASSENGER car tire replacement sales reached a new record high in 1957 and indications are that another record will be set in 1958. Passenger car tire replacement sales for 1957 were approximately 57,400,000, an 8 per cent increase over 1956 when 53,165,000 replacement passenger car tires were sold, and 4.9 per cent greater than the previous record year of 1946 when sales of replacement passenger car tires reached 54,700,000. Year-end reports indicate the rubber industry sold about 107,500,000 tires for passenger cars, trucks and tractors in 1957. These figures, which include original equipment and replacement tires, were 5 per cent greater than in 1956 when 102,332,000 tires were sold. The all time record year for tire sales was 1955 when automobile production was at its peak. In that year tire sales amounted to 112,157,000.

We attributed the increased tire sales to the constantly growing number of automobiles, the trend toward suburban living, and improved highways and roads. There were approximately 63,000,000 cars and trucks in use in the United States at the end of 1957, compared with 60,600,000 at the end of 1956. By the end of 1958 there will be about 65,000,000 cars and trucks in use in this country. Many of these vehicles will require replacement tires during the next 12 months. An important factor in the year ahead will be the record 7,170,000 automobiles sold in 1955. The demand for replacement tires for these cars will be very strong. Automobile production in 1957 is estimated at 6,125,000 units, a 5.6 per cent increase over the 1956 production of 5,802,000.

Current reports indicate new car production in 1958 will be approximately 5,850,000. We estimate gross sales by the rubber industry in 1957 will amount to $6,500,000,000, an increase of 90 per cent in the 10-year period since 1947 when sales volume was $3,400,000,000. We are constantly finding new uses for rubber and the outlook for growth in the industry is very good. The Firestone Tire & Rubber Company is better prepared for business development, industrial activity and for defense operations than ever before in its history. Five major installations were put into operation by the company during 1957. They included new tire plants in Havana, Cuba, and Manila, Philippine Islands; a new test center, including a race track and proving grounds, at Fort Stockton, Texas; a plant for the manufacture of Airide springs at Noblesville, Indiana; and a butadiene plant at Orange, Texas, with an annual capacity of 40,000 tons a year of this basic ingredient for synthetic rubber.

Early this year, a pilot plant for the production of Coral rubber will begin operations in Akron. This new rubber, developed by Firestone research, has characteristics so nearly identical to natural rubber that it may eliminate the need for costly stockpiling of natural rubber and make the United States, in case of an emergency, completely independent of foreign sources of rubber. The synthetic rubber industry is becoming increasingly important and has possibilities for growth well beyond many other industries.

Synthetic rubber gained a greater proportion of the market as more manufacturers, both in the United States and abroad, recognized the advantages of its stability in price and the improved quality gained by using more of it in their products. Natural rubber prices were more stable in 1957 than in 1956, due principally to the increasing trend to synthetic rubber. Synthetic accounted for 63.3 per cent of rubber consumption in 1957 compared with 60.9 per cent in 1956 and 58.5 per cent during 1955.

Estimates of world consumption of natural and synthetic rubber for 1957 are 3,172,000 long tons, an all time high, compared to 3,038,000 long tons consumed in 1956. United States consumption of rubber for 1957 amounts to an estimated 1,475,000 long tons. Of this total about 934,000 long tons will be synthetic rubber. In the ten years since 1947 consumption of synthetic rubber has increased in the United States from 442,000 long tons to 934,000 long tons. In its preparation for future demand for rubber products and for industrial growth, Firestone spent $68,768,000 for expansion during its 1957 fiscal year (which ended October 31, 1957). The expansion was the greatest in the 57-year history of the company and some $10,000,000 ahead of the $58,570,000 spent for expansion, improvement and modernization during the 1956 fiscal year.

In addition to the new facilities completed in 1957 we modernized or expanded every one of our existing plants. The company also acquired the Electric Wheel Company in Quincy, Illinois, and incorporated it into the Firestone Steel Products Company, a subsidiary which is a major manufacturer of automobile rims, milk cans, automobile grills and other steel products. These expansions are all indicative of our confidence in the future. The fact that we have achieved record sales and earnings during 1957, shows that our confidence is justified.

Harvey S. Firestone, Jr.

Chairman of the Board, Firestone Tire & Rubber Co., Akron, Ohio

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Busy Year in 1958 . . .

J. W. KEENER

THE American rubber industry may expect business in 1958 to equal, or exceed, 1957 totals. The United States will probably consume about 1,500,000 long tons of new rubber in 1958, compared with the 1955 high of 1,530,000 long tons and 1957's estimated total of 1,480,000 long tons. Of the new rubber consumed in the United States in 1958, about 64.5 per cent will be domestically produced man-made rubber, compared to 63.5 per cent in 1957, the previous peacetime high. World consumption of rubber in 1958 will probably set a new record of 3,200,000 long tons, excluding the use of man-made rubber in the Soviet Bloc, about which little is known. This compares with world usage of 3,153,000 long tons estimated for 1957. Man-made rubber will account for about 42 per cent of the total world 1958 rubber consumption (excluding Soviet man-made) compared to 40 per cent in 1957.

Production of tree rubber is not expected to exceed 1,900,000 tons this year (1957) or in 1958, and there is little possibility of an increase before 1960. The remainder of the world demand must be supplied by man-made rubber. Privately financed expansion of American man-made rubber facilities, following purchase from government by industry in 1955 and 1956, has assured ample production capacities in this country. Our nation's capacity for production of man-made rubbers should increase to 1,700,000 tons by the end of 1958. This compares with 1,372,000 capacity at the beginning of 1957 and 1,200,000 in 1956.

Construction of new man-made rubber plants in England and West Germany is nearing completion while new plants in France and Italy are expected to begin production in 1958, and synthetic rubber plants in Japan, India and The Netherlands are presently receiving "serious consideration." At the beginning of

1957, the man-made rubber producing capacity of the Free World, outside the United States was 150,000 long tons. Current expansion programs indicate that the rest of the Free World will be capable of producing 240,000 long tons of man-made rubber during 1958 and will have capacity for producing 350,000 long tons by the end of next year. In 1956 and 1957 the Free World outside the United States showed a greater proportionate increase in the use of man-made rubber than did the United States.

The Free World, excluding Soviet man-made rubber, used 70,000 more tons of man-made rubber in 1957 than it did in 1956, while the United States increase in use over 1956 is estimated at 63,000 tons. Excluding the Soviet Bloc, the rest of the world used 1,265,000 tons of man-made rubber in 1957. This is about 133,000 more than in 1956. World crude rubber consumption will decline about 17,000 tons. This marks the first year since 1952 (when Korean war crude rubber consumption controls were in effect) that world crude rubber consumption has declined from the previous year. Continuing high prices of crude rubber, in addition to the expansion of man-made rubber producing capacities in the United States and Western Europe, are responsible for the sharp increase in man-made rubber consumption.

J. W. Keener

President, B. F. Goodrich Co., Akron, Ohio

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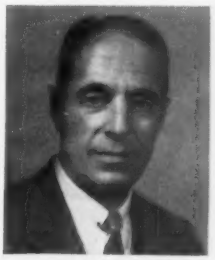
Black Performance Satisfactory . . .



THOMAS D. CABOT

THE past year was a satisfactory one for the carbon black industry. United States demand for carbon black-reinforced rubber products was the second highest in history. Total carbon black shipments to both domestic and export markets were just slightly under the previous high. The foreign market, with record carbon black consumption. Moved closer towards regaining the position it held prior to World War II of accounting for nearly half of the total carbon black consumed. Today, a large part of this foreign demand is supplied by local plants. Historical trends indicate that U.S. rubber and carbon black consumption will continue to expand with the long-term growth of the economy. Deviations from trend lines must be expected, however. No appreciable contraction in activity has been experienced since the peak year 1955. A corrective phase before growth trends can be reaffirmed is a current possibility.

We are in a period of great technological change. Rubbers today are custom designed to meet a complexity of uses. Carbon blacks must be exactingly produced to fulfill the specific requirements of these various applications. A technical battle is also being waged in the carbon black industry to combat the inflationary effects of rising labor, material, and transportation costs. Improved techniques have thus far succeeded in absorbing a large part of higher costs, but as optimum efficiencies are reached this becomes increasingly difficult.

Carbon black capacity continues to be in excess of total demand. In 1957, U. S. shipments ran at less than 80 per cent of industry capacity. A similar situation is expected in 1958. While we affirm our faith in the long-term growth of the carbon black and rubber industries we must also recognize that the society in which our free economic enterprises are founded has been challenged by a system of state compulsion. Only by successfully meeting this challenge can we ensure a continuance of a free society and an atmosphere in which growth potentials may be realized.

Thomas D. Cabot

President, Godfrey L. Cabot, Inc., Boston, Mass.

Predicts 114,000,000 Tires . . .

WILLIAM O'NEIL

THE rubber industry's 1958 prospects loom encouragingly in the nation's economic outlook for the new year. Our research and development of new products have created new opportunities for us and we at General Tire confidently expect a greater demand not only for tires, but for all the valuable things our chemical resources have discovered in plastics, basic metals and rocket propulsion. Enough of our other major industries, like automotive, building, chemical, plastics, food and steel, will make the same appreciable gains as the rubber industry to balance out the year equal to or slightly better than 1957. The end result will be satisfactory. The rubber industry's biggest 1958 gain will come from a greater demand for replacement tires. The demand will outstrip 1957 sales by as much as 5 per cent. This increased replacement demand plus original equipment requirements for new automobiles and trucks will require the rubber industry to produce an estimated 114,000,000 units of all types in 1958.

A significant step-up in the Federal Aid Highway Program will occur during the new year. Much of the nation's multi-billion dollar road building will move off the drawing boards into actual construction late in 1958 or early in 1959, providing a greater need for truck and giant off-the-road tires which the industry is already prepared to meet. So much of our nation's economy is tied into this highway program the sooner it can be completed, the faster all business in the United States will realize the growth potential created by our expanding population. Congress must recognize the importance of roads in our national defense effort and, if need be, make it a "crash" program to unsnarl any red tape now delaying progress.

The 1958 outlook for General Tire itself appears excellent. Our expansion into new fields, heightened by our own research and development of many new products, improves our position immeasurably for the future. We have major interests in rubber, rockets, chemicals, plastics and entertainment, all of which are growth industries with wonderful potential in our expanding economy.

General Tire's AeroJet-General Division is the nation's largest manufacturing operation devoted exclusively to the research and development of rockets, missiles, rocket propellants and rocket chemicals. It has had an important role in the nation's rocket and missile developments for years, and it is expected to assume an even more important role in 1958 and in the future. For security reasons, we are not at liberty to disclose our work in rockets, but it can be said our nation's scientists are thinking years ahead in this challenging field.

In both chemical and plastics fields, we foresee continued growth. Virtually every day new products and improved end uses are being developed in these two great industries and we expect plastics to be used in many more ways and places than it is now used.

Of significant importance to General Tire's position in the rubber industry is its new $10,000,000 synthetic rubber plant at Odessa, Texas. We have a completely integrated operation with this modern rubber-making facility and we should benefit tremendously from its beginning in 1958. Synthetic rubber today is filling 65 per cent of the industry's needs and its usage will increase as our research discovers more things made of rubber, like Air Springs, that do a better job than other materials.

The rubber industry is facing the biggest growth era in its history. Tires will always be an important part of our business, but we must continue our search for new products. Few companies in this country are still making only the product they were making when they started operating. It's the company that has expanded its product lines that is growing. Our entry into many product lines has been sound, and for this reason, we feel General Tire's outlook is bright.

William O'Neil

President, General Tire & Rubber Co., Akron, Ohio.

Looks Forward to Steady Growth . . .

THOMAS ROBINS, JR.

THE non-tire segment of the rubber industry is expected to consume about 582,000 tons of rubber in 1958, 38 per cent of the country's total rubber consumption. The dollar sales volume of non-tire rubber products already exceeds that of tires and should continue to grow at a faster rate as the result of the development of many new products and increased usage of such standard non-tire items as conveyor belting, foam rubber, industrial hose, floor coverings and rubber footwear products. Natural crude rubber and synthetic rubber are expected to be in adequate supply in the coming year. Total domestic consumption of rubber in 1958 is estimated at 1,525,000 tons, of which about two-thirds will be synthetic produced in the United States and the remainder imported natural crude.

We expect continued steady growth in the use of belt conveyors for handling ores, coal, crushed stone and other bulk materials. Indications are that conveyors will be used to a greater extent for long overland haulage where they can move materials more efficiently than trucks or rail cars. One example of this type of installation is the 2-mile conveyor system Hewitt-Robins installed in 1956 at Little Valley, Utah, to move a mountain of stone and earth fill to the edge of Great Salt Lake for construction of a 13-mile railroad embankment across the lake. Experience has proved that this conveyor system can do the job faster and more economically than would have been possible by any other means.

Early in 1958 the 1,400-foot-long passenger conveyor system recently installed at the new Dallas airport will go into daily operation. Built by Hewitt-Robins, this system is several times larger than any other passenger handling conveyor system. We are confident it will attract wide attention to this new method of moving people, and may lead to a strong public demand for passenger conveyors similar to the public demand which created a vast market for air conditioning a few years ago.

We also look forward to steady growth in the use of foam rubber and urethane foam as a cushioning material in automobiles and furniture, as an interlining in clothing and in miscellaneous newer applications that are now in the early stages of development. Hewitt-Robins is operating two plants for the production of foam rubber and another plant entirely devoted to the new urethane foam, both the polyester and polyether varieties.

Thomas Robins, Jr.

President, Hewitt-Robins, Inc., Stamford, Conn.

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Genuine Confidence . . .

W. J. HANEY

CHARTING the business outlook for a coming year is probably more difficult at the beginning of 1958 than for any year since World War II. Even so, this is a key—a vital—year and we must view it with greater care and play it closer to the line than probably has been necessary in the past few years. We are facing a decisive test as we find our way into the satellite-missile era. Are our companies—the mechanical rubber goods segment of the rubber industry—meeting the challenges with missile-age product developments, techniques, and know-how? The best answer, I believe, is yes. Late in 1957 we were in the midst of production cutbacks and a widely-heralded "readjustment"; which, in my view, certainly does not mean an approaching "bust". On the basis of sales estimates, we are looking at 1958 with genuine confidence.

Southern California, a principal market for our company, has been favored with extraordinary expansion in electronics, aviation, metals, chemicals, etc., and allied industries. This is true, of course, in other areas of the nation. Certainly these and other industries have not expanded beyond their markets. In fact, they are on a golden threshold and will do much to stabilize and improve not only the rubber industry, but our general economy.

How far our individual companies go in 1958 and beyond, depends, of course, on the strength of our competitive manufacturing and selling—and on the sharpness of management. The "readjustment" at the end of 1957 can be a force for good. It may have a favorable effect on the inflationary trend; labor contracts and other units of cost may be more realistic; and management has been alerted.

We must be mindful that, as time goes on, we have a tougher and tougher battle to maintain a proper profit margin. I believe management has gathered in the loose ends of the "boom" and that we are moving into a generally unsteady early-1958 in good strength—to be followed by a stronger market with productive capacity ready to take care of 1958 business profitably, efficiently, and effectively.

W. J. Haney

President, Kirkhill Rubber Co., Brea, Calif.

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Fabric Outlook Brighter . . .

C. F. THOMAS

ALTHOUGH total fabric requirements for the rubber industry during 1957 were slightly below last year's early forecasts, the outlook for 1958 seems somewhat brighter. The decline in fabric purchases by the rubber trade, last year, was directly attributable to an increase in general fabric production by textile mills owned by members of the rubber industry itself. With the demand for cotton chafers rapidly decreasing in the tire industry, many of the rubber manufacturers' own textile mills were converted to the production of square woven fabrics. As a result, the "open" market for this type of fabric to the rubber industry was considerably diminished. During 1958, however, some of the slack should be taken up by the growing demand for fabrics in such end-product uses as packings, V-belts, transmission belts, conveyor belts and hospital sheetings. In addition, newly developed applications for both cotton and synthetic textiles in the rubber industry should supplement the normal sales volume. New export subsidies available for fabrics to foreign countries should also strengthen the market in 1958.

Unfortunately, streamlined production of textile products for the rubber industry is not to be expected. An ever-greater variety of fabric needs for specific end-uses, and an ever-growing number of fabric-base specifications for competitive rubber manufacturers preclude the possibility of any standardized production program. Although this lack of standardization means higher costs, in a highly competitive economy such as ours it is basically sound because it also means a wider variety of available fabrics and a greater opportunity for individuality on the part of each rubber manufacturer.

Charles F. Thomas

Vice-President, Turner Halsey Co., New York, N. Y.

Sales Prospects Look Good . . .

J. P. SEIBERLING

SALES prospects for the rubber industry in 1958 look good. Total passenger tire sales should continue at their present levels and truck tire demand may be expected to improve after a 1957 drop. The nation's business economy as a whole will see a slight dip during the first half of 1958, with a recovery in the second six months. The entire year, while not a record-breaker, should be good enough to rank just below the best two or three years the country has enjoyed. In the year now ending (1957) the rubber industry itself again has shown its strength. It has given further evidence that the job of keeping America's automobiles—old and new alike—equipped with tires and rubber accessories is linked to an ever expanding market. Even though some industries experienced lulls or dips in 1957, the tire industry (in 1958) expects to show a 6 per cent production increase over last year to meet current demands.

Although none of the industry can afford complacency, we should look forward to 1958 with optimism about further sales increases. Several factors indicate good reason for this attitude. Today 75 per cent of America's families own cars. These motorists traveled half a trillion miles in their cars in 1956 and for the current year (1957) the mileage will be increased. It is apparent that people consider the automobile a virtually indispensable part of their lives. Motor vehicle travel has almost doubled in the last ten years and in 1956 people spent nearly 10 per cent of their disposable income to operate their cars. With no severe setbacks in sight for the economy, it's reasonable to expect this trend to continue.

The most important object for tire manufacturers and retailers in 1958 should be to sell safety. Although the percentage of traffic deaths per miles traveled has decreased recently, the actual number of fatalities continued towards all-time highs. In 1956, around 40,000 Americans died in traffic accidents. It will be worse this year (1957). In 1958 the tire industry can render a great service by concentrating on selling the safest tires made.

J. P. Seiberling

President, Seiberling Rubber Co., Akron, Ohio.

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Latex Consumption Expanding . . .

ARTHUR NOLAN

CONSUMPTION of all latices in the U.S.A. during 1957 is expected to be in excess of 160,000 long tons solids content, an increase over 1956's 156,000 tons but less than 1955's record 167,000 tons. Again, as during 1956, when it first occurred during peacetime, more chemical rubber latices were consumed than natural Hevea latex; with a 1957 estimated 53 per cent for chemical and approximately 47 per cent for Hevea. The butadiene-styrene types will probably show an increase over 1956, and a new historical high, with about 67,000 tons consumed. Other chemical rubber latices, nitrile and neoprene types, appear not to have had their usage increased during 1957 at approximately 17,600 tons, almost the same as 1956.

There were no significant price changes for chemical rubber latices during the year; this characteristic of a stable price being one of their strongest virtues. It simplifies purchasing, cost accounting, compounding, pricing of finished goods and inventories.

We can also be reminded that consumption of the lower priced butadiene-styrene latices (under 30c) continues to hold firm and together with those over 30c, increased their percentage share of total consumption. Hevea latex spot prices during the year ranged from 34c to 44¾c per pound total dry solids, for tank car delieveries, F.O.B. East Coast Port of Entry. It is this "unpredictable" changing price which, possibly more than any one thing, restricts the full employment of Hevea latex for its acknowledged superior technical properties in many products. It is interesting to note, that even at the 34c price level, there was no significant movement to increase Hevea contents in latex recipes, even with the opportunity to better the finished product.

Formulation changes have become a cumbersome and slow task. In addition, of course, consumers and manufacturers expected that perhaps the low prices for Hevea would not endure for a long period under the influence of the international market.

To state the problems "begs" the question: "What can be done to stabilize Hevea latex prices at some fair level?" Very little, I am afraid. "Field" or "tree" latex is still the feedstock for *both* solid natural rubber and concentrated latex, and so the two appear to be inseparably linked. There seems little likelihood of natural rubber price fluctuations being narrowed to less than a cent per pound per year in the near future; as much as Hevea latex people agree this would permit Hevea latex to be considered as a raw material on a straightforward value basis.

Of course, whether a stabilized price would increase or decrease Hevea latex consumption would depend where in the 30c to 40c range its stabilized price would fall. When one speaks of latex, one cannot neglect to speak about the so called "plastic" latices usually considered apart from the "rubber" latices discussed above. Large consumption continues, particularly in the paint, coating, saturating and adhesive fields with such items as polystyrene, polyvinyl chloride, acrylic, vinyl acetate and the like. The consumption also continues to expand rapidly.

Arthur Nolan

Vice-President, Latex & Rubber, Inc., Baltimore, Md.

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Automobile Outlook Unchanged . . .

THE size of the automobile market in 1958 will depend on general business developments and consumer reaction to these developments. Normal turnover of the existing consumer stock of cars, coupled with an average rate of growth, would provide a retail market somewhat above the 6 million cars sold in 1957 (including 5.8 million U. S. cars and 0.2 million imports). Car sales are likely to be below normal, however, because of consumer hesitancy in making commitments. A decline in business activity affects car buying not only by consumers whose incomes have been reduced, but also by those who have not been hurt. The present decline has been relatively rapid, but it has curtailed the buying power of only a small fraction of consumers.

Total employment declined about 1 per cent between August and November. Hours worked in manufacturing also were reduced. The buying power of total wages and salaries was down only 1½ per cent, however, even after allowing for slight price increases. This decline was cushioned in part by increased government benefit payments. Other forms of personal income, except agricultural, were virtually unchanged. The trend of general business, coupled with uncertainty regarding military developments, has caused other consumers to postpone buying. Excessive postponement can increase the depth of the decline unnecessarily.

There are no serious excesses of the 1956-57 prosperity to be corrected. Consumer buying of cars and use of automotive credit in that period were not out of line. There also was no housing boom during the period. Only in the areas of additions to business inventories, plant and equipment, and exports did expenditures climb to rates from which a temporary falling back was indicated. The problem in any decline is to prevent it from becoming cumulative—i.e., lower spending generating lower income, which in turn discourages spending still more. To turn around such a decline, an increase in total spending is necessary.

Government expenditures will be increasing during 1958. State and local governments will spend more for payrolls and new

construction, particularly schools and highways. These expenditures will be met at least in part, however, through higher tax rates. The federal government will step up its military procurement from currently reduced levels. A change in federal tax rates is not indicated at the present time.

Business and consumer spending are the questionable segments. Consumers played a key role in the 1953-54 decline by maintaining their spending in the last half of 1953 and increasing it throughout 1954. Consumer demand also supported rising residential construction during 1954. Nonresidential construction was firm throughout the 1953-54 adjustment. Business expenditures for machinery and equipment were reduced, but the cutback was not sharp.

Tax reduction, made possible by the lower military spending, was an important factor in this maintenance of consumer and business spending. When the readjustments in the military program and in business inventories were completed, the economy was on solid ground for resumption of an upward trend starting in the fourth quarter of 1954.

Maintenance of consumer spending and construction are again essential during the present declining phase of the economy. The initial adjustments in business activity are not as great this time as in 1953-54 because there is no sharp cutback in the military program. On the other hand, the prospects for tax reduction are not as favorable.

Postponement of normal buying is not warranted for the great bulk of consumers and business firms. Prices are not likely to decrease for most products and services, particularly where a trade-in is involved, such as for a car. A new car purchaser can make as favorable a deal on his used car trade-in at this time as at any time in the year. Incomes of the two-thirds of the work force in nonagricultural employment outside of manufacturing are not likely to shrink significantly. Even in manufacturing, the great bulk of employes should not be affected seriously.

The year 1958 promises to be another test of our ability to minimize the interruptions to forward progress in the economy. There are some inevitable adjustments which have started and will continue into the early part of 1958. There is no necessity for postponement of normal buying for fear of a serious decline. We have the ability to cope with such a decline, should it develop, and lay the groundwork for renewal of the long-run uptrend.

In the auto industry, we expect to have below-normal years when total business activity temporarily declines, but we also expect to follow such years with above-normal years. The long-run outlook is not changed as a result of a slowing down in one year. The auto market is sensitive to shifts in consumer incomes and psychology, however, and we are concerned lest these shifts be allowed to proceed too far.

George P. Hitchings

Economist, Ford Motor Co., Dearborn, Mich.

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Predicts British Expansion . . .

STUART C. COVELL

THE total output of the British rubber industry in 1957 was substantially above that of 1956, and there is every reason to expect that expansion will continue throughout the present year. The recession of 1956, precipitated by the Government's anti-inflationary policy, affected more particularly those sections of the industry which are primarily concerned with supplies to motor manufacturers. Though anti-inflation measures still continue, and capital expenditure is being cut back in both public and private sectors, much of the ground lost in 1956 has now been recovered. Moreover a considerable volume of new business is expected to result from the progressive adoption by motor vehicle designers of the new air springs and other forms of rubber suspension.

On the proofing side, large orders have been placed, both by the Navy and by the mercantile marine, for the new inflatable life rafts, which will shortly be compulsory equipment in virtually all British shipping except long range cargo and passenger vessels. These life rafts, which were developed as a result of an Admiralty investigation of the factors affecting marine survival, have already set a new standard of safety at sea. During the first year of their compulsory use on British shipping vessels, the number of lives lost in the fishing fleet fell from an average of 53 per annum to nil, while the number of men saved was 57. All that remains now is to have them adopted for ocean going shipping at the next meeting of the International Convention in 1960.

Other growing points of the industry include flexible tanks and containers of various kinds, light-weight tarpaulins and tents, rubber-based paints and adhesives, anti-corrosive linings, protective clothing for industrial purposes, and rubber and resin-rubber soling materials. Early last year the rising proportion of British-made shoes with leather uppers which had rubber or resin-rubber soles reached and passed the 50 per cent mark. This year may well see a decision by the British Army to change over to molded footwear for infantry use.

In June of 1958, the International Synthetic Rubber Company's new GR-S plant near Southampton is due to come into production. This, together with various special purpose rubber factories already operating or under construction, will provide the country with a domestic source of synthetic rubbers which should stand the industry in good stead if and when present proposals for the establishment of a Free Trade Area in Western Europe come to be implemented. There is no doubt that rubber manufacturers in Great Britain have more to gain than to lose by the enhanced opportunities of a wider market. Moreover the industry is well served by the Federation of British Rubber and Allied Manufacturers, which provides an invaluable means of co-operation in all matters of common interest connected with supplies of raw materials, export markets, and international trade generally.

Stuart C. Covell

Director, Federation of British Rubber and Allied Manufacturers, London, England.

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Increasing Chemical Consumption . . .

THE rubber industry during 1957 has been more fortunate than the average. This in turn means that the chemical suppliers to the rubber industry have also benefited. Rubber consumption in 1957 showed an increase over the previous year and it is confidently expected that the year of 1958 will be at least equal to 1957. Even though there is some doubt surrounding the increased sales of new cars during the year of 1958, certainly the replacement tire sales will be high and perhaps higher than in any other year to date. The accent on higher rates of speed because of travel on turnpikes, limited access highways, and better roads in general, naturally will cause faster wear and quicker replacement. With better roads, the average car owner will drive more miles this year.

Another factor contributing to the consumption of rubber chemicals is the increasing tendency to use more synthetic rubber. Synthetic rubber in general requires more accelerators and antioxidants than does natural. It is reasonable to expect that the trend to the increased use of synthetic rubbers will continue during 1958.

1957 saw the usual number of new chemical additives for rubber introduced to the trade. These were the result of considerable research expenditure, and are indicative of the continuing efforts of the chemical industry to cooperate with the rubber industry to produce better rubber products.

C. W. Christensen

Monsanto Chemical Co., Akron, Ohio

Natural Outlook Good . . .

H. C. BUGBEE

WORLD demand for natural rubber continues at a saturation pace and promises to maintain this level for a number of years to come. In 1957, the natural rubber industry produced approximately 1,930,000 tons of rubber for a world that consumed some 1,900,000 tons. About 550,000 tons of natural's total consumption was used in the U.S.—comprising about 37 per cent of the over-all 1,475,000 tons used in this country. Use of natural is necessary in those areas where its resilience and heat dissipation characteristics make it superior. Heavy truck and airplane tires fall into this category, and according to one outstanding American rubber leader "the present consumption pattern in the U.S. of about 63 per cent synthetic, 37 per cent natural, is approaching the limit as measured by product value and service. We cannot go much further with the presently available types of synthetic rubber. Synthetic polyisoprene is a replacement for natural rubber, but the cost of this rubber is, at this stage of the art, much too high to consider its use in normal, peacetime commerce."

The 37 per cent of total U.S. consumption registered by natural for 1957 probably comes within one or two percentage points of being the floor below which natural should not drop regardless of price differential. For 1957, the average price for natural (No. 1 RSS current month delivery—f.o.b. cars New York) ran about 31c, 8c higher than synthetic's GR-S at 23c. During the closing months of the year, however, natural got down to the 27c - 29c level from the 34c average maintained throughout 1956 and 32c average the first six months of 1957.

In those areas where natural or synthetic can be used almost interchangeably—perhaps a third of the over-all uses—the rubber industry is understandably guided by price. If natural prices in the months to come maintain a closer relationship to synthetic than in the two years just past, 1958 could see a rise in the percentage of natural used in the U.S. This would hold true particularly if, during 1958, the production of truck tires, the largest single segment user of natural, rose at a higher percentage rate than that of passenger tires.

Coming back to 1957 world figures of 1,930,000 tons natural produced as opposed to 1,900,000 tons consumed, we believe that in a world consumption of this magnitude, a surplus of 30,000 tons is negligible. In voicing this opinion, I join other rubber leaders who foresee world demand absorbing full natural production in the years ahead.

In 1956 natural rubber consumption exceeded output by 17,000 tons. While 1957 has moved a peg from the record consumption-over-production figures established last year, it remains part of the close ratio pattern that puts natural in the enviable position of selling all it can produce.

It is partially because of this saturation demand and the fact that high yielding rubber plantations can produce rubber at under the present price of GR-S that the American rubber industry during the past couple of years has either entered into natural rubber production on its own or has increased holdings already under cultivation. All of the Big Four rubber companies have considerably upped natural rubber production activities.

In Malaya, particularly, natural rubber growers are actively taking advantage of the almost certain market for their wares. The new Malayan government that came into being as an independent nation in August, 1957, is strongly aware of the place rubber plays in the Malayan economy and is making every effort to encourage replanting with higher yielding stocks.

In a statement made on Malaya's accession to independence status, Dr. Ismail, Malaya's Ambassador to the United States, pointed out, "The progress made since the end of the war in replanting old low yielding trees with trees that yield three times as much rubber is a measure of the confidence the industry has in its future."

Dr. Ismail pointed out that "Up to the end of 1956 estates had replanted some 500,000 acres of 25 per cent of the total estate acreage, and with the introduction of Government schemes to assist replanting on estates and smallholdings (estimated to cost up to $93 million, U.S.A.), a record acreage was replanted last year (1956)." Dr. Ismail estimated that "no less will be replanted this year (1957)" and noted that with the help of government assistance, smallholders as well as estates had replanted record areas during 1956 and were expected to do the same during 1957.

The average yield per tapped acre on estates in Malaya today is 496 pounds per year. New replantings now going in will produce anywhere from 1,200 to 2,000 pounds per acre per year. In addition, rubber scientists are working on methods to increase tree yield through injection of stimulants. In another move to increase natural production, efforts are being directed at making available to rubber growing millions of acres of virgin Malayan jungle.

Not only will higher yield increase production, it will also put natural in a better position to compete on price. In an industry as price and margin conscious as rubber manufacturing here, this is an all-important factor.

While natural rubber producers are bending every effort to up their production, they are also researching towards improving their product. In Asian and European laboratories rubber technologists are developing naturals that provide toughness and wear resistance and are working towards improving the resiliency and heat dissipation advantages that natural already has. To make certain that advances developed abroad are rapidly transmitted to rubber manufacturers here, a technical service is being planned that will make available to U.S. customers all natural advances as they are developed.

Natural today is in a good spot. There aren't many industries with a forecast of sales for all they can produce. For the next several years natural will grow—and sell—somewhere between 1,900,000 and 2,000,000 tons of rubber. Admittedly, during the years immediately ahead, growing world demand for all rubber will underwrite a good part of these sales. The producing industry though is not just relying on over-all economic forces. Natural will sell too because research is improving the product and costs are being pared. When the world business climate dictates that natural has to compete on the basis of price and quality, the story, therefore, will remain the same—natural will still sell all it can produce.

H. C. Bugbee

President, Natural Rubber Bureau, Washington, D.C.

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Careful Planning Necessary . . .

R. E. MASTIN

THE outlook for 1958 seems to be one filled with mixed feelings and much conjecture among businessmen throughout the nation. Our experience at La Favorite for the past year, coupled with indications we see for some industrial shrinkages this year, have determined plans for very careful planning of production schedules and cost savings at every possible point. Sales increases appear to foretell corresponding decreases in profit. We are confident that we will make 1958 a profitable year by diligent care in every phase of our operation. I think it should be further recognized that management, and employees must realize that the economy of our country cannot afford wage and price increases unless there are appreciably better values for the customer and greater productivity by the worker. Every one of us must produce more, which will result in higher earnings, for we all have a stake in the preservation of a sound economy in support of our utmost need for strong defense in this and the coming years.

R. E. Mastin

Chairman of the Board, La Favorite Rubber Manufacturing Co., Hawthorne, N. J.

Challenging Year Ahead . . .

OVER-ALL, 1957 was the most prosperous year in history with the economy reaching new peaks for the third successive year. No new year ever started with the over-all economy on such a high plateau as today. Fully alert to recent and continuing slowdown, I expect the level of business to be high in 1958 with output larger than in most years. Also, I anticipate stiff competition which, of course, is the priceless ingredient of our system. 1957 was spurt then sag; 1958 looks like mild dip then climb—with government policies strengthening public confidence and federal, state and local government programs adding new push to production and employment. The immediate economic situation may not be as rosy as we all want but from where I sit the 12-month outlook is far better than nail-biting pessimists think. The shower isn't over yet, but the sun shows signs of breaking through the clouds.

In looking ahead we should keep the economy in perspective, taking into account the attitude of the people as well as the statistical indicators. The chief interest of everyone today is for the United States to be strong enough to survive—now and future—in face of new, science-bred hazards and the Communist economic drive. Some uncertainty affects the mood as our resolute and capable nation prepares to meet the test. Be assured that an Administration, which has contributed so much in the creation of this era of prosperity and peace, will act vigorously with every means at its disposal to promote these blessings. It also is planning and moving with urgency to mobilize this country's vast material and technical resources for the greatest long-haul national security.

In my opinion, 1958 will be a year free Americans act as they always have responded in their greatest hours—confronting trouble with unflinching nerve, accepting challenge with an iron will to win, and—despite many obstacles and some setbacks—mastering their problems with brains, work and backbone. I foresee, so to speak, an outpouring of this deep, historic spirit by government and people. It not only will advance security and peace, but also give the economy a forward shove. Among plus factors in evidence are stepped-up defense orders, history's greatest highway project moving faster from blueprint to construction stage, continued population growth and private spending, reflecting confidence.

Sinclair Weeks

Secretary of Commerce, U.S. Dept. of Commerce, Washington, D. C.

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Synthetic Comes of Age . . .

H. R. THIES

THE synthetic rubber industry can look upon 1957 as the year in which his new giant "came of age". Plans for expansion and modernization, begun at the time of transfer from government to private ownership in early 1955, were substantially completed during 1957. Over-all production capacity rose from 1,400,000 long tons to approximately 1,700,000 long tons by year end, emphasizing the confidence of private enterprise that the United States and the free world can, and will, consume increasing quantities of synthetic rubber. This confidence was substantiated in 1957 by continued preference for synthetic rubber in a market free from the disquieting influences of material shortages or widely fluctuating prices of the natural product. Synthetic consumption in the United States increased 8 per cent against an over-all increase of 2½ per cent for total new rubber.

As to the future: prospects for the industry are good. Based on a solid foundation of research, development and production know-how, synthetic rubber will continue to dominate our domestic market and fill the ever-increasing demand overseas. Forward estimates of new rubber consumption, world-wide, indicate an increase of over 40 per cent within the next eight years. This increase stems largely from greater overseas consumption brought about by higher living standards. With free world natural rubber availability essentially plateaued at its present level, synthetic production is the only possible solution to an impending world-wide shortage.

Our own company, as both a major consumer and supplier of synthetic rubbers, completed major expansions in 1957 in recognition of growing demand. Our Houston synthetic plant for producing dry styrene/butadiene rubber was expanded to a level of 220,000 long tons, making it the world's largest single facility for production of this type. Late in 1957, our synthetic latex operations in Akron were expanded by 50 per cent to fill increased demand for high solids styrene/butadiene latices by the foam, textile and paper industries. Additional capacity for producing nitrile rubbers and latices was also brought on stream in Akron.

Capacity to produce does not make a market, and the synthetic rubber industry must necessarily provide better products and services to maintain and improve upon a hard earned position in the market. Improvements in polymer uniformity and color, better packaging and delivery service were all important marketing factors in 1957 and will continue to receive emphasis in 1958. We have every confidence that the synthetic rubber industry in 1958 will be able to give the rubber consumer the improved products he has every right to demand and that the year will be one of solid achievement for the producer and consumer.

H. R. Thies

General Manager, Chemical Division, Goodyear Tire & Rubber Co., Akron, Ohio

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Record Tire Sales . . .

TIRE industry sales in 1958 will approach the all-time high established in 1955. It is estimated that industry sales in 1958 will total 112,735,000 pneumatic tires of all types, compared to 110,530,000 in 1957. The record year for the industry is 1955, when 114,244,000 tires were sold. Shipments of passenger car tires, including original equipment on new cars and replacements for old tires on present cars, are expected to total about 93,000,000 units in 1958. This compares with 91,050,000 in 1957 and the record 93,668,855 in 1955. Replacement tire sales in 1958 will increase nearly 4 per cent over the estimated $1.5 billion sales this year. Although this is a large sum in the aggregate, it amounts to only 50 cents per each hundred dollars spent for consumer goods by Americans.

There are approximately 56,100,000 passenger cars registered today and I predict that by the end of 1958 there will be 58,400,000 cars registered in the United States. Today, 12 per cent of American families are two-car owners and in another 10 years, 20 per cent (one in every five) will have at least two cars.

B. F. Goodrich recently announced a new high-speed six-ply tubeless tire designed to provide maximum safety at top turnpike speeds and yet give long wear at regular speeds, a combination that is unique in the industry. Usually, a tire has one or the other feature.

The new tire, called "Silvertown 125", provides safety at speeds far faster than any motorist can safely travel. Shipments of truck and bus tires in 1958 will be about 14,400,000 units, an increase over 1957 shipments of 13,750,000, but slightly under the 1955 record of 14,766,392. Farm and implement tire shipments will total 3,400,000 in 1958, compared to 3,325,000 in 1957 and the record of about 5,200,000 in 1948. Miscellaneous pneumatic tires, including aircraft and industrial, will total 2,400,000 in 1958, about the same as in 1957.

In 1957, the company completed a $6,000,000 expansion of its tire production facilities at Los Angeles and a major addition of facilities for producing off-the-road tires for large construction equipment at its Miami, Okla., plant. A major distribution center in Charlotte, N. C., the fourteenth to be established by B. F. Goodrich since 1950, was completed during 1957, and construction was started on three others.

E. F. Tomlinson

President, B. F. Goodrich Tire Co., Akron, Ohio

Reclaimers See Stable Year . . .

GILBERT K. TRIMBLE

THE past year has not been outstanding as far as the use of reclaimed rubber is concerned. It is believed when the United States Department of Commerce figures are compiled, that they will show a consumption of approximately 270,000 long tons in 1957. This is very nearly the same as for 1956, but falls considerably short of the several preceding years. The average consumption for the last ten years has been 280,000 tons. The statistical relationship between the use of reclaimed rubber and new rubber is an important one in any consideration of trends in our industry. In 1957 the ratio of use of reclaimed rubber to total new rubber was 18.3 and in 1956 it was 18.8. Expressing this in another way, 15.5 per cent of all the rubber used in the United States in 1957 was reclaimed rubber, and in 1956 the figure was 16.0 per cent.

Going back five years, in 1952, 18 per cent of all the rubber used was reclaimed rubber and ten years ago, in 1947, 20.5 per cent of the total was reclaimed rubber. In other words, while more and more new rubber has been fabricated into the many consumer products with which we are familiar, the use of the reclaimed material has not kept pace.

Reclaimed rubber is used advantageously in many products, both from an economy and a quality standpoint. It is probable that one reason why the use of the material has not increased is because of its price. Prices have increased about 5 per cent during 1957; whereas, the prices of synthetic rubber have remained generally unchanged, and consumption has greatly increased.

The Rubber Reclaimers Association has been quite active through the years of its existence, and is presently conducting an educational campaign towards a better understanding of the advantageous uses of reclaimed rubber. It is believed by members of the Association that full advantage has not been taken of the availability of the many grades of reclaimed rubber designed for so many useful and specific purposes.

Early in 1957 a book was published by our Association and given wide distribution. This was, "Manual of Reclaimed Rubber", edited by John Ball, (past chairman of the Rubber Division of the American Chemical Society). It is proving to be a valuable tool to rubber engineers and compounders, and has gained general acceptance throughout the world. For instance, it is being translated into Japanese.

The year 1957 witnessed a tragedy to one of the major producers of reclaimed rubber. A disastrous fire completely destroyed the plant of the Pequanoc Rubber Company early in the year. An announcement by this company in December stated that they would not rebuild. This passing of a well thought of and long established company is a considerable loss to the rubber industry.

It is always extremely difficult to predict the fortunes of our economy, or any segment of it. At this time the picture is particularly cloudy. Most economists and business observers have made note of the present fall off in business, but there seems to be a wide difference of opinion as to the extent or depth of our present recession.

My opinion, as far as our industry is concerned, is that we shall see a lower demand for reclaimed rubber in 1958 than in 1957, but that it will not be lower than 260,000 long tons. I base this on the fact that predictions by others are for a very good tire year. As the year ended, the order books for the reclaimed rubber industry for January shipments were heavy, which is a very comforting note on which to welcome in 1958.

G. K. Trimble

President, Rubber Reclaimers Association, Inc., and President, Midwest Rubber Reclaiming Co., East St. Louis, Ill.

Scrap Market Dull . . .

S. I. FREEDMAN

THE scrap rubber market for the year 1957, if noted for one factor, was its stability at a comparatively low level. Although the reclaim industry as a whole had fairly good business, it did not reflect itself in scrap purchases, as the policy of the industry had been to reduce inventories. Consumption of scrap by the reclaimers averaged approximately 20,000 tons per month in 1957, whereas consumption in 1956 averaged 22,000 tons per month. In general, the availability of scrap tires was greater than the demand. These two factors accounted for the relative easiness in the market. Mixed tires in the Akron market were sold at 50c per ton less than at the beginning of the year, but the eastern market declined $1.50-$2.00 per ton from the levels of 1956. Butyl tube prices, after fluctuating rather sharply in 1956, leveled off at the beginning of '57 and remained steady throughout the year. Split parts remained rather constant, with the exception of #1 Peelings, which fluctuated from a high of approximately $40.00 down to $26.00 and closed the year at around $30.00 per ton. Black and red tubes more or less followed the butyl tube pattern in steadiness.

The entire scrap industry is undergoing a great change in methods of collection. Carload freight rates once again were increased by 7 per cent during 1957, and indications are that they may be further increased in 1958. This factor, plus steadily increasing labor costs has made it economically inexpedient for many of the old accumulators to continue handling scrap rubber.

The main suppliers of scrap tires today are those dealers who are able to realize some return primarily from the selection of usable or recappable casings and by so doing handle scrap tires as a by-product. The prospects for 1958 do not look any more enticing than 1957 and the utmost cooperation on the part of the reclaimers and the dealers is necessary to keep open the channels of supply through 1958.

S. I. Freedman

H. Muehlstein & Co., Inc.; President, Scrap Rubber and Plastics Institute, N.A.W.M.D.

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Foresees Bright Future . . .

J. R. MOORE

ALTHOUGH the final figures for 1957 will probably show a new record for Gross National Product, the year closed with the general economy tending downward and with a certain degree of mixed emotion and uncertainty regarding the immediate outlook for 1958. In many segments of industry it appears that production capacity has temporarily caught up with — and in some instances — exceeded consumption. Based on the present tendency toward inventory reduction, the extra available production capacity may be expected to exert pressure on present markets and certainly makes for more intense competition for the immediate future. Working against these restraining pressures are counter pressures of increasing wages, increasing transportation costs, the possibility of higher taxes, and other general increasing expenses of doing business. We may, therefore, certainly expect a further squeeze on profits during the early part of 1958.

The well-being of the rubber chemical business is dependent upon the well-being of the rubber industry which, in turn, is

affected to a large degree by the automotive industry. Present indications are that shipments of original equipment passenger tires for 1957 will exceed those for 1956 by approximately 7.1 per cent. Shipment of replacement passenger tires for 1957 should be approximately 7.9 per cent greater than 1956 and the replacement tire business for 1958 is variously estimated at a 3 per cent to 4 per cent increase over 1957. Therefore, even allowing for some possible decrease in automobile new car production in 1958, it would be quite possible for total over-all shipments of tires for 1958 to equal or exceed total shipments for 1957.

Non-tire use of rubber for 1957 is estimated at about 38 per cent of the total new rubber used and is estimated to contribute somewhat more than 50 per cent of total dollar sales volume. Non-tire rubber consumption is estimated at 39 per cent, or more, of total new rubber use for 1958.

The typical 1949 automobile was reported as having a total of 369 body and chassis rubber parts, exclusive of tires, and approximately 85.5 pounds total weight. The typical 1957 counterpart is reported as having 442 body and chassis rubber parts, exclusive of tires, with a weight of approximately 97 pounds. The new use of air springs for automobiles gives promise of increasing rubber use in cars.

The state and federal road building programs could contribute considerably to the 1958 prospects for the rubber industry if present programming difficulties can be worked out and if spending by state and local governments is not restricted by tax collections.

Present indications are that any slow-down in movement of rubber chemicals and related items during the early part of 1958 will be improved as the year advances and the consuming public moves into the buying season for automobiles, tires, appliances, footwear, flooring and other rubber consuming products.

New elastomers and new products based on the industry's continuous research and development programs promises a bright future for the rubber industry and we enter 1958 with every confidence that this new year could set new records for total rubber consumption and dollar sales volume.

J. R. Moore

President, Harwick Standard Chemical Co., Akron, Ohio.

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Cites Low Profit Margins . . .

PIERCE SPERRY

I BELIEVE that 1958 will be another year of disgracefully low profits for the molded, extruded, lathe-cut, and chemically-blown sponge rubber segment of the rubber industry. During the past few years, several new companies have come into existence in our industry. During these same past few years, most of our old and new companies have added a large amount of new manufacturing capacity by the way of new and larger plants. Automation or better methods of manufacture have also done much to increase our available manufacturing capacities. These facts, along with the fact that many of our customers who purchase our parts are not enjoying the volume of business they did a year or so ago, will force us in this business to face quite a challenge in order to run our plants on a profitable basis this year. Too many of us today can not stand to see some of our available capacity sitting idle, one or even a part of a shift. This causes us to quote prices way below anything which a good, sound business policy would permit.

When one hears of manufacturers in this business who are today showing a profit of less than 1 per cent after taxes, and many, many others who average around 3 per cent after taxes, we should realize that we can not go much lower, price-wise, and stay in business. I am sure that all of us in this industry realize that these are disgracefully low profits. Our challenge now will be to develop new and better processes by which to manufacture our products, to develop new usages for the items we can make, and to do a better selling job than we have done in the past few years.

We in this industry can accomplish these aims by ceasing to blame our competitors, large and small, for our present profit troubles and take a good look at our own conditions. In our particular case, it isn't the large manufacturer any more than the small manufacturer who is to blame for these present-day conditions. Actually, we ourselves—all of us—are the ones who have to shoulder this blame and "clean our own houses" before blaming our competitors for today's conditions in this great industry.

Pierce Sperry

President, Sperry Rubber and Plastics Co., Brookville, Ind.

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Increased Balloon Sales . . .

THE writer is no seer as far as the rubber business is concerned nor do I profess to be the criterion or authority for the rubber toy balloon and playball industry. However, with a resistance to high priced toys for 1958, particularly during the first half of the calendar year, we anticipate even a greater increase for 1958 in both our toy balloon division and playball division. We are entering our fifth year in the manufacture of vinyl playballs of which we make a complete line in all sizes including a non-official basketball, football and inexpensive sports kit. Our reception on these latter items from the major variety chains and other large outlets has been quite successful. Orders for the first of the year on our 1958 line are far above preceding years and at slightly increased prices but maintaining in most instances the same retail categories as we have previously had. We have expanded our facilities in both toy balloons and playballs considerably in the calendar year of 1957 and through new merchandising of both lines we do, as previously stated, expect increased sales for the remainder of the calendar year.

R. R. Gill, II

President, National Latex Products Co., Ashland, Ohio

A Summation

Viewed in all its aspects, 1958 bids fair to be a most fruitful year for the rubber industry. 1958 may not be another 1955, but it will be a year of growth, a year of progress, a year of profit and a year to look forward to with anticipation. In total, then, we see for 1958:

- **U. S. new rubber consumption of 1,520,000 long tons including 548,000 long tons of natural and 972,000 long tons of synthetic.**
- **Synthetic rubber production (U. S.) of 1,255,000 long tons.**
- **Sales of $6,500,000,000.**
- **Tire sales of 112,730,000 units.**
- **Capital expenditures of $193,000,000.**
- **Net profits of $300,000,000.**
- **Automobile output of 6,000,000 passenger cars.**
- **An increase in synthetic consumption abroad.**
- **U. S. synthetic rubber exports of 275,000 long tons.**
- **World new rubber consumption of 3,240,000 long tons.**

Rubber Age

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An investigation of the light absorption characteristics of carbon black dispersions

The Absorption Spectrum of Carbon Black Dispersions

By ANDRIES VOET *Research Department, J. M. Huber Corp., Borger, Texas*

THE TRANSMISSION of light through dispersions of finely divided solids is most sensitive to variations in particle size. It is well known that the reinforcing characteristics of carbon blacks in rubber depend on the size of the pigment particle. Thus, the light absorption of a carbon black dispersion could conceivably be related tc its reinforcement properties.

Light attenuation in dispersions occurs by scattering. The freely moving particles in carbon black dispersions are not the elementary particles, but are irregularly shaped loosely bound aggregates of a size of the order of 0.1 to 1 micron *(1)*.

While the theory of light scattering has been sufficiently developed to include spherical monodispersed particles of any size *(2)*, the formidable difficulties encountered in treating the problem of the light scattering of irregularly shaped polydispersed systems of particle sizes comparable to the wavelength of the light have made it desirable to use a more empirical approach.

Experimental Procedure

Materials Used. The carbon blacks used were dried commercial products, dispersed in a white mineral oil, $d\ {}^{4}_{30} = 0.8770$, $n\ {}^{25}_{d} = 1.4808$, viscosity 160 cP at 30°C. Unpelletized blacks, after drying, were incorporated in the vehicle as obtained. Pellets were crushed and screened through a 200-mesh screen.

The blacks were first mulled into the mineral oil with the aid of a Hoover muller to form a free flowing dispersion of 3 to 15 per cent by weight, dependent upon the type of black. Dilutions of 0.001 to 0.005 per cent were made in two or three stages. All dispersions were homogenized by thorough agitation. No stabilizers or additives were used. The dispersions did not show any noticeable settling at room temperatures over a period of several days.

Some dispersions were made in a polydimethylsiloxane (DC 200 of Dow-Corning, viscosity 1.5 cS at 25° C.). They were prepared by dilution of the concentrated mineral oil dispersion with the silicone fluid. Such dispersions settled rapidly and were frequently homogenized by agitation.

Method. Since the attenuation of the light in a dispersion of carbon black is relatively high, sufficient accuracy in the measurements can be obtained by determining the total loss in energy of the incident light beam. By comparing this loss with the energy loss in the pure vehicle, the loss due to scattering can be accurately determined.

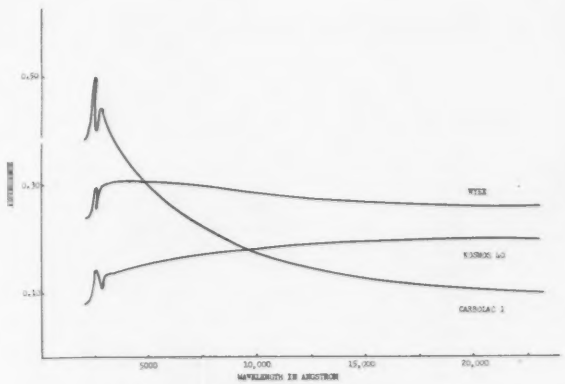

FIG. 1—Effect of wavelength upon absorbance.

Note: This paper was presented before the Division of Rubber Chemistry, American Chemical Society, at New York, N. Y., September 12, 1957.

TABLE I—VALIDITY OF BEER'S LAW FOR AN SRF BLACK IN THE VISIBLE RANGE

C	4000Å		5000Å		6000Å		7000Å	
Wt % × 10^3	A	A − 10^5 C	A	A − 10^5 C	A	A − 10^5 C	A	A − 10^5 C
1	0.105	0.105	0.110	0.110	0.114	0.114	0.118	0.118
2	0.210	0.105	0.220	0.110	0.229	0.114	0.236	0.118
4	0.426	0.106	0.445	0.111	0.460	0.115	0.476	0.119
6	0.625	0.104	0.660	0.110	0.680	0.113	0.696	0.116
8	0.814	0.107	0.860	0.108	0.880	0.110	0.904	0.113

Absorption measurements were carried out in the infrared, visible and ultraviolet ranges. A Beckman DU spectrophotometer with tungsten and hydrogen light sources was generally employed in the range 2,100 to 10,000Å, while for several samples a Beckman DK2 spectrophotometer was used, yielding significant data over the range of 2,100 to 24,000Å.

Defining the light transmittance T as the ratio of intensities of incident light I_o and transmitted light I, the absorbance A is defined as the negative logarithm to the base 10 of the transmittance.

$$A = -\log T = \log \frac{I_o}{I} \qquad (1)$$

The Beckman spectrophotometers permit a direct reading of the absorbance.

Experimental Results

Validity of Beer's Law. In very dilute dispersions, in the absence of multiple scattering, the total scattering effect of the dispersed phase is found by summation of the individual contributions of the dispersed particles. For such systems, Beer's law should be valid.

Table I indicates that Beer's law is valid for dispersions of an SRF black in the concentration ranges of 0.001 to 0.010 per cent by weight for the visible range. Table II shows the same result for several concentrations of an HMF and an ISAF dispersion for the entire measured range.

Absorbance of Dispersions in Mineral Oil. Figure 1 indicates the absorbance of dispersions of three carbon blacks of concentrations of 0.001 per cent by weight in mineral oil over the entire wavelength range investigated. Up to 2840Å smooth curves appear, but at shorter wave lengths marked maxima and minima are observed. Similar curves are shown by all black dispersions, making it advantageous to consider the ultraviolet range separately.

It appears that for the visible and infrared ranges, linear relations are found when the absorbance is plotted against the wavelength in a logarithmic plot. This is shown in Figures 2 and 3 for 12 different blacks, covering the range from high color blacks to semi-reinforcing blacks. Thus, for the visible and infrared range the following relation holds:

$$\log A = b_o - n \log\lambda \qquad (2)$$

in which b_o is the intercept and n the slope of the lines of Figures 2 and 3, while λ is the wavelength of the light.

Relation (2) can be derived from the Angstrom approximation $R = c/\lambda^n$, whereby R is the coefficient of attenuation and c and n parameters *(3)*.

Table III shows the values of n and b_o calculated from the data of Figures 2 and 3 for the various blacks, together with the surface areas determined by nitrogen absorption S_n and the elementary particle diameters determined electronmicrographically. It appears that both factors n and b_o, when plotted against the logarithm of the surface area S_n of the blacks, exhibit a linear relation, as shown in Figures 4 and 5.

TABLE II—VALIDITY OF BEER'S LAW FOR DISPERSIONS OF HMF AND ISAF BLACKS IN VARIOUS CONCENTRATION RANGES FOR ENTIRE MEASURED RANGE

Wavelength	HMF			ISAF	
Å	C = 0.005% 1/5 x A	C = 0.002% 1/2 x A	C = 0.001% A	C = 0.002% 1/2 x A	C = 0.001% A
10,000	0.188	0.190	0.191	0.266	0.270
9,000	0.187	0.189	0.190	0.274	0.277
8,000	0.186	0.188	0.188	0.285	0.290
7,000	0.183	0.186	0.186	0.296	0.302
6,000	0.181	0.184	0.183	0.314	0.315
5,000	0.173	0.181	0.180	0.328	0.334
4,000	0.174	0.177	0.176	0.346	0.354
3,000	0.168	0.170	0.170	0.357	0.365
2,750	0.141	0.142	0.142	0.310	0.311
2,500	0.159	0.161	0.162	0.356	0.354
2,350	0.120	0.121	0.122	0.263	0.260

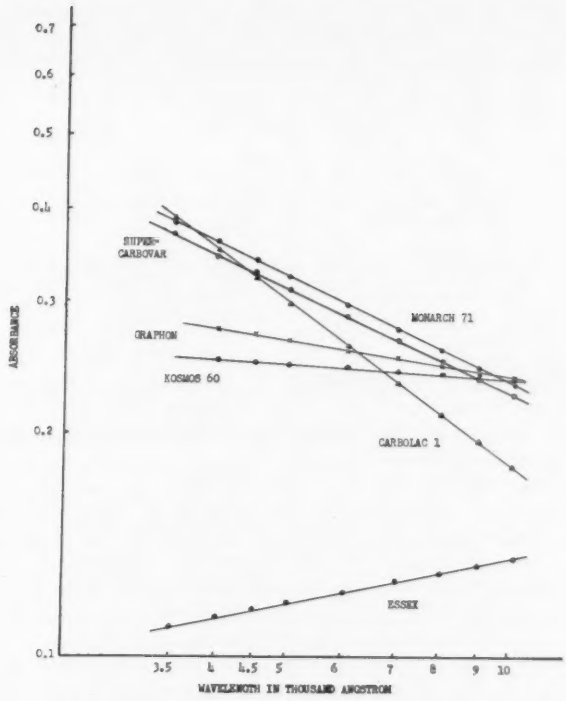

FIG. 2—Logarithmic plot of absorbance versus wavelength.

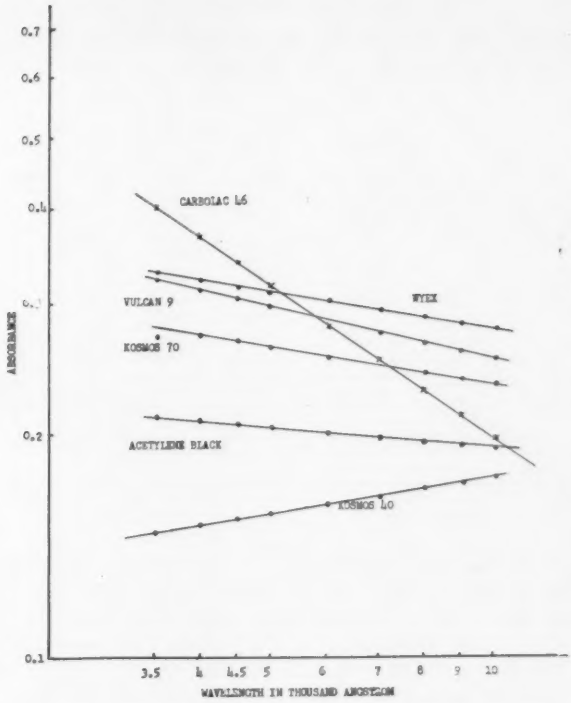

FIG. 3—Logarithmic plot of absorbance versus wavelength.

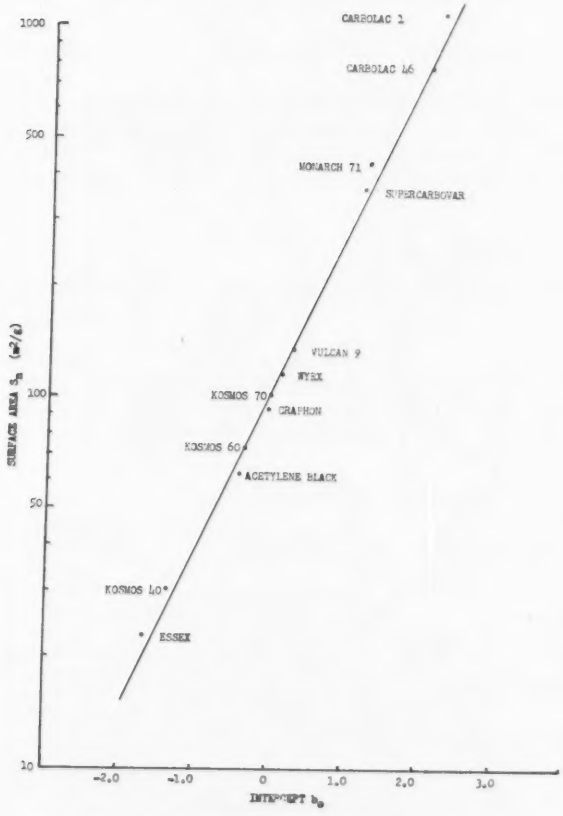

FIG. 4—Relation between intercept b_o and surface area.

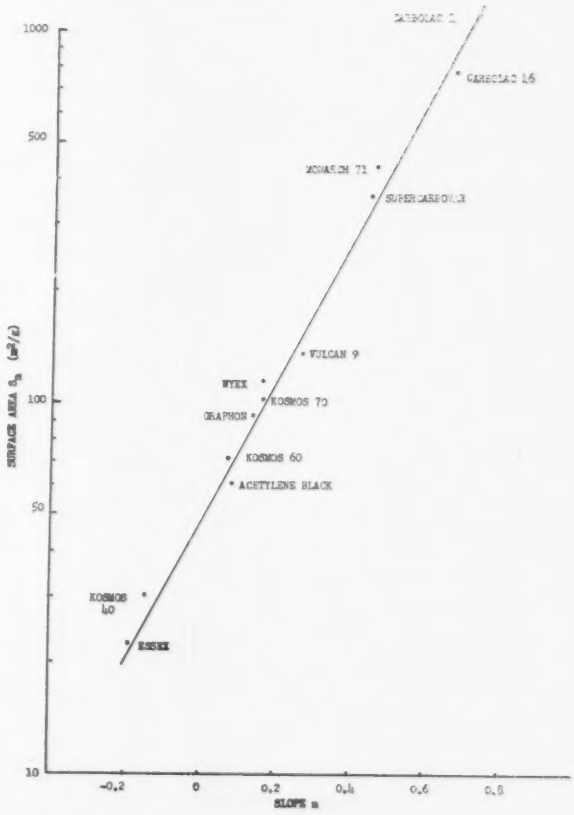

FIG. 5—Relation between slope n and surface area.

TABLE III—VALUES OF n AND b_o, SURFACE AREAS AND ELEMENTARY PARTICLE DIAMETERS OF VARIOUS CARBON BLACKS

Black	Symbol	S_n m^2/g	d mμ	n	b_o
Carbolac 1	HCC	1040.0	12.2	0.74	2.20
Carbolac 46	HCC	757.0	19.5	0.69	2.07
Monarch 71	HCC	426.0	22.2	0.47	1.26
Supercarbovar	HCC	355.0	19.2	0.46	1.20
Vulcan 9	ISAF	133.6	22.8	0.24	0.35
Wyex	EPC	114.6	22.0	0.17	0.13
Kosmos 70	HAF	101.2	32.0	0.17	0.05
Graphon *	——	92.7	39.0	0.15	—0.01
Kosmos 60	HAF	69.4	46.0	0.08	—0.32
Acetylene Black	——	59.6	54.0	0.29	—0.34
Kosmos 40	HMF	30.1	106.0	—0.16	—1.39
Essex	SRF	22.0	145.0	—0.19	—1.65

* Graphitized channel black obtained through the cooperation of Godfrey L. Cabot, Inc., for which the author wishes to express his appreciation.

The ultraviolet spectra of the carbon blacks are shown in Figures 6 and 7 for dispersions 0.001 per cent by weight. The curves are smooth down to wavelength of 2840Å, which appears to be a turning point in the λ-A relation, since at lower wavelengths sharp maxima and minima appear. Plotting the absorbance at 2840Å against the logarithm of the surface area S_n, linear relations appear, as is shown in Figure 8.

Absorbance of Dispersions in Silicone Oils. Dispersions of several carbon blacks were made in a polydimethylsiloxane of a viscosity of 1.5 cS. Figure 9 indicates the A vs. λ plot for 0.001 per cent by weight dispersions in the ultraviolet range. For the visible and infrared ranges, as in mineral oil, a linear log A vs. log λ plot was found and relation (2) is valid. The following data indicate the value of n and b_o:

Black	n	b_o
Carbolac 1	0.45	0.92
Supercarbovar	0.36	0.53
Acetylene Black	0.03	—0.12

The ultraviolet spectrum in silicone oils appears to differ considerably from the spectrum of mineral oil dispersions, while the values of n and b_o are lower.

Discussion of Experimental Data

Absorbance and Particle Size. The data indicate that in the visible and infrared ranges the absorbance for the color blacks strongly decreases with increasing wavelengths. Blacks such as ISAF, HAF, and EPC show a smaller decrease, while HMF and SRF blacks show an increase. Thus, at shorter wavelengths the color blacks have a higher absorbance than SRF, but at longer wavelengths a reversal takes place and SRF has a higher absorbance than color blacks in the infrared.

It must be noticed that color blacks not only have smaller elementary particles than, for instance, SRF blacks, but the particle clusters which form the freely moving units of the dispersion are equally smaller for color blacks than for SRF blacks. This is easily observed by means of a light microscope with an oil immersion objective. These facts form the basis for an

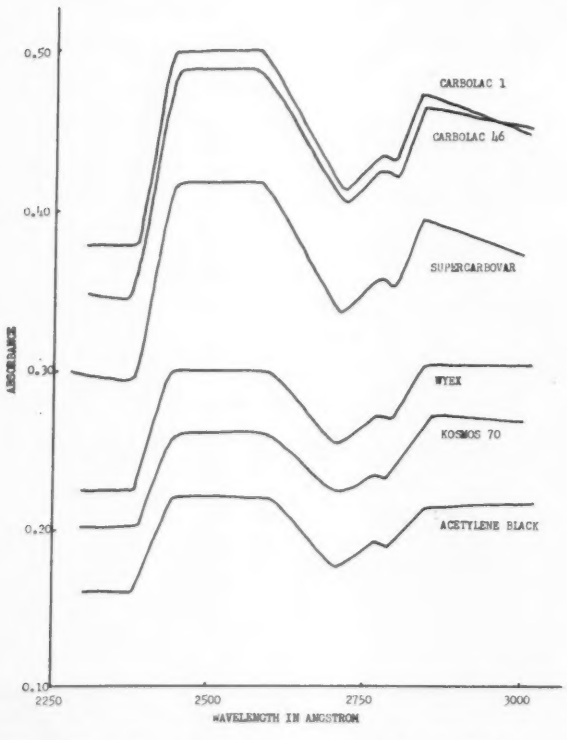

FIG. 6—Effect of wavelength upon absorbance in the ultraviolet range.

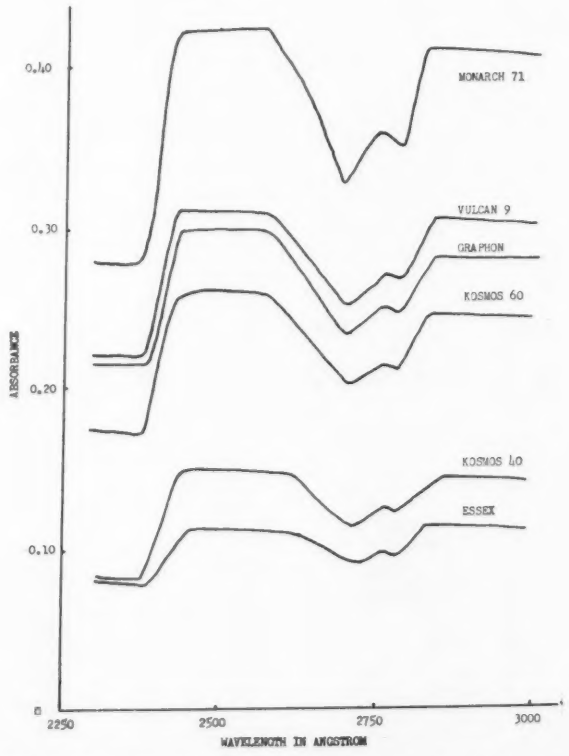

FIG. 7—Effect of wavelength upon absorbance in the ultraviolet range.

explanation of the observed changes in absorbance with the wavelength.

The theory of light scattering of dispersions *(4)* indicates that for particles much smaller than the wavelength of the light, which obey Rayleigh's law, the intensity of the scattered light, and thus the absorbance, is proportional to the sixth power of the diameter. For a given weight of black which is monodispersed into such small spherical particles, the absorbance increases with the third power of the diameter, since for a given weight the number of particles is inversely proportional to the third power of the diameter.

For particles comparable to the wavelength of the light, for which the Mie theory is valid, the scattering intensity is proportional to the fourth power of the diameter and for a given weight of black the absorbance is proportional to the diameter. Finally, particles which are large compared to the wavelength of the light merely act as a geometric screen and the absorbance is proportional to the square of the diameter. For a given weight of black in this range, therefore, the absorbance decreases proportionally to the particle diameter.

Thus, in the infrared, the freely moving particle clusters are small compared to the wavelength and the larger SRF particles show the highest absorbance. In the visible and, especially, in the ultraviolet range, the particle clusters are large compared with the wavelength of the light and the smaller color black particles show the highest absorbance, in accordance with experiments.

The relationship between the scattering cross section S and the actual cross section is

$$S = k\pi r^2 \qquad (3)$$

whereby k is the scattering coefficient and r the particle radius.

In view of the above, the scattering coefficient k might be expected to be unity in the ultraviolet range, since the particles act as a geometrical screen. However, in view of Babinet's principle, k generally approaches the value 2.

TABLE IV—COMPARISON OF SCATTERING SURFACE AREAS S_c FOR $\lambda = 2840$Å WITH SURFACE AREAS S_n OF VARIOUS CARBON BLACKS

Black	A_{2840}	S_n(m²/g)	S_c(m²/g)	S_c/S_n
Carbolac 1	0.472	1040	49.5	0.04
Carbolac 46	0.466	757	48.9	0.06
Monarch 71	0.413	426	43.4	0.10
Supercarbovar	0.390	355	40.9	0.11
Vulcan 9	0.308	133.6	32.3	0.24
Wyex	0.302	114.6	31.7	0.28
Kosmos 70	0.265	101.2	27.8	0.28
Graphon	0.270	92.7	29.4	0.32
Kosmos 60	0.248	69.4	26.0	0.37
Acetylene Black	0.221	59.6	23.2	0.39
Komos 40	0.141	30.1	14.8	0.49
Essex	0.113	22.0	11.9	0.54

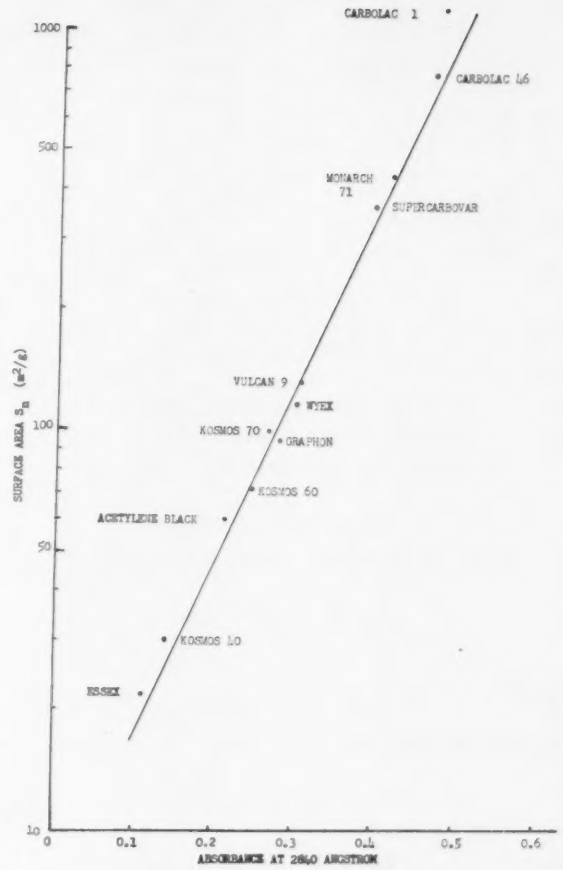

FIG. 8—Relation between absorbance at 2840Å and surface area.

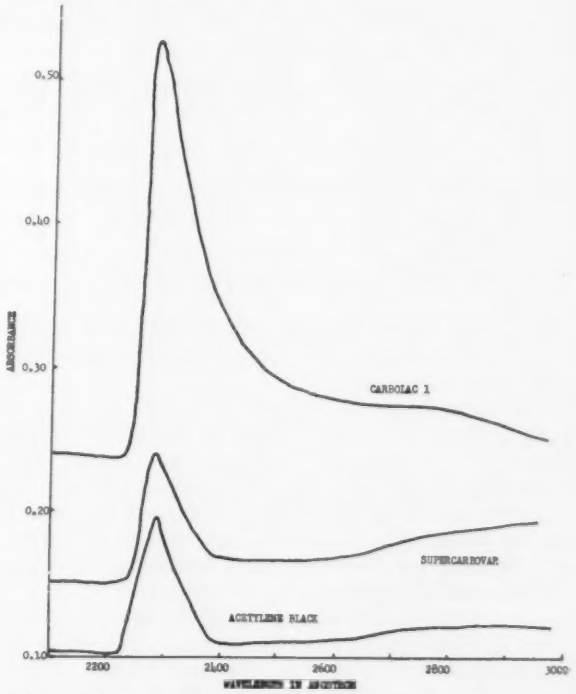

FIG. 9—Effect of wavelength upon absorbance for dispersions in silicone oil.

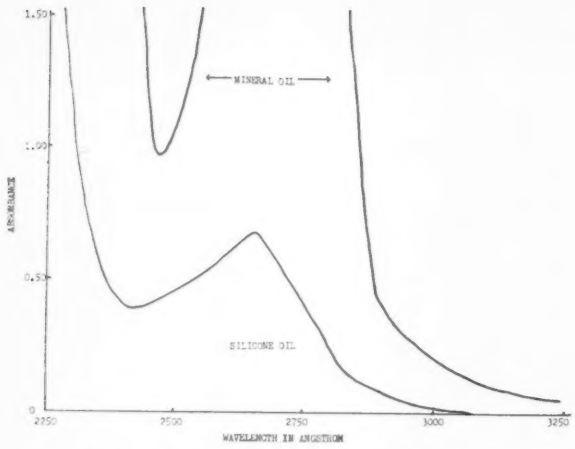

FIG. 10—Absorbance of mineral oil and of silicone oil.

Scattering Surface Area. The transmission T is given by the expression:

$$T = \frac{I}{I_0} = e^{-SNl} = e^{-tl} \qquad (4)$$

whereby N is the number of particles per unit of volume and l the length of the light path. The product SN is known as the turbidity t *(4)*. Thus:

$$A = -\log T = \frac{tl}{2.303} \qquad (5)$$

Since in our experiments l = 1.00, we find:

$$t = 2.303A \qquad (6)$$

Defining as t_w the scattering per gram of black, t_w is obtained by dividing t by the total weight of the particles in one milliliter of the dispersion. In our dispersions, with a carbon black concentration of 0.001 per cent by weight, with a specific gravity of the vehicle of 0.88, we find:

$$t_w = (SN)_w = 2.62 \times 10^5 A \qquad (7)$$

whereby $(SN)_w$ is the scattering cross section per gram of black. Denoting as S_c the scattering surface area per gram of black, we find for spherical particles:

$$S_c = 4(SN)_w = 1.05 \times 10^6 A \qquad (8)$$

Table IV compares the scattering surface areas S_c for λ = 2840Å with the surface areas S_n, while the ratios S_c/S_n are also indicated.

The above data show that the scattering surface area of the particles at 2840Å is not twice the actual surface area, as was first expected for this wavelength range. The discrepancy is the more pronounced, the smaller the particles. This observation may be explained by the fact that not the elementary particles, but particle aggregates form the units which act as screens for the light.

Electronmicrographs show these clusters to be loosely packed irregularly shaped aggregates of elementary particles. In such units, only the outer particles will fully contribute to light scattering, with less and less contributions coming from the more enclosed elementary particles. For an SRF black, where the aggregate has few particles, the discrepancy is not nearly as pronounced as for color blacks, where the unit might consist of hundreds of elementary particles. The relationship of Figure 8 may be explained in this manner.

Ultraviolet Spectrum. The curves of Figures 6 and 7 show great similarities for the different blacks. While the absorbances of the various blacks do not obey the relation (3) in the near infrared, the absorbance curve is smooth between 4000 and 2840Å. However, remarkable differences are apparent between the absorbance values for different blacks between the two wavelengths, as may be seen from Table V.

The first four blacks, which are all oxidized color blacks, show an absorbance at 2840Å which is much larger than the absorbance at 4000Å. The other, unoxidized blacks exhibit either a small positive or a small negative difference. Table III indicates that such differences cannot be explained by differences in elementary particle size, in view of the fact that three of the four color blacks have particles not greatly different in size from the ISAF and EPC blacks. In addition, it does not seem likely that the differences depend on the surface area, since ISAF, HAF, and EPC blacks show differences of the same order as HMF and SRF blacks. The data, therefore, could indicate that the ultraviolet spectrum might differentiate between oxidized color blacks and unoxidized rubber blacks.

Spectra of Dispersions in Silicone Oil. While in the visible and infrared ranges the relation (2) is valid, the actual values for b_o and n in the silicone based dispersion are considerably lower than the corresponding values in the dispersions based on mineral oil. Equally, the ultraviolet spectra are markedly different, with only one sharp peak at 2285Å.

This observation emphasizes again that the spectra are dependent upon the pigment as well as the vehicle, in view of the fact that the refractive index of the particle at the particle-vehicle interface enters prominently into the phenomenon of light scattering. Figure 10 shows the absorbance of both mineral and silicone vehicles against air. It appears that the sharp maxima and minima in the spectral curves of the dispersions are in the same wavelength ranges which show pronounced changes

TABLE V—DIFFERENTIAL IN ABSORBANCE FOR VARIOUS BLACKS AT 2840 AND 4000Å

	2840Å	4000Å	2840Å—4000Å
Carbolac 1	0.472	0.351	0.121
Carbolac 46	0.466	0.367	0.099
Monarch 71	0.413	0.362	0.051
Supercarbovar	0.390	0.348	0.042
Vulcan 9	0.308	0.308	0.000
Wyex	0.302	0.317	—0.015
Kosmos 70	0.265	0.268	—0.003
Graphon	0.280	0.275	0.005
Kosmos 60	0.248	0.248	0.000
Acetylene Black	0.212	0.209	0.002
Kosmos 40	0.141	0.150	—0.009
Essex	0.113	0.113	0.000

in the absorbance of the vehicles, leading to anomalous dispersion, indicating abrupt changes of the refractive index at the particle-vehicle interface.

The absorption spectrum of a dilute carbon black dispersion in a mineral oil affords a rapid identification of the type and class of black.* Since only a few milliliters of a dispersion of 0.001 per cent of black are required, a complete analysis is made with only a few hundredth parts of a milligram of a black.

The procedure followed is to plot the absorbances in the visible and infrared range in a logarithmic plot and to establish the factors n and b_o. Absorbances at 5,000 and 10,000Å are generally sufficient to determine these factors. From Figures 4 and 5 the surface area may be calculated. The result can be checked with the absorbance at 2840Å, for which Figure 8 may be used.

To determine whether the black has the oxidized color type of spectral curve, if high in surface area, the difference between the absorbances at 2840 and 4000Å is determined. A postive value above 0.040 would indicate a color black.

* After this work had been completed, an article appeared (A. Ficrensa, *Rubber Age*, Vol. 80, p. 69, 1956) describing a method for the classification of carbon blacks by measuring the ratio of optical densities for violet and red light in dilute aqueous black dispersions stabilized with protective colloids. The rather limited scope of this work permitted only the conclusion that this ratio is characteristic for a black.

Summary

The light transmission of carbon blacks dispersed in mineral oils follows Beer's law at concentrations of 0.01 per cent by weight and below in the wavelength range investigated, 2250 to 24,000 Angstrom.

In the visible and infrared range, a linear relation exists for all blacks between the logarithms of absorbance and the wavelength, the slopes and intercepts of which are characteristic of the black and directly related to its surface area.

In the ultraviolet range maxima and minima occur. Characteristic differences were found between oxidized color blacks and unoxidized rubber blacks.

The scattering coefficient is somewhat smaller than unity for coarser blacks and very much smaller than unity for finer blacks, indicating, in agreement with optical and electrical data, that the dispersed particles are aggregates of elementary particles.

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(4) Oster, G., *Chem. Revs.*, Vol. 43, p. 319 (1948).

Coming Next Month...

Radiation Curing of Silicone Rubber—By L. M. Epstein and N. S. Marans, Materials Engineering Department, Westinghouse Electric Corp., East Pittsburgh, Penna.

Experimental results indicating that radiation cured silicone rubbers have increased resistance to aging are presented; radiation sources, physical reactions and practical vulcanization techniques are discussed.

Thermal Diffusivity of Butyl Rubber and Its Compounds. Part I: Determination of Diffusivity Coefficients—By Donald R. MacRae and R. L. Zapp, Enjay Laboratories, Linden, N. J.

A report on the results of experiments to determine thermal diffusivity coefficients for butyl rubber and some of its compounds, with data on the range of the coefficients and influence of such factors as state of cure and pigment loading. (Note: This paper was originally scheduled for publication in the January issue.)

Report on a Laboratory Investigation to Develop Improved Lightweight Refueling Hose—By H. J. Borstell, C. K. Chatten, S. A. Eller, E. Solon and A. A. Stein, Material Laboratory, New York Naval Shipyard, Brooklyn 1, New York.

Description of the flex testing of different models of commercially available refueling hose, with a discussion of the testing techniques and evaluation of the performances of various elastomers.

Swelling Behavior of Rubbers Compounded with Reinforcing Pigments—By B. B. S. T. Boonstra and Eli M. Dannenberg, Research and Development Department, Godfrey L. Cabot, Inc., Cambridge 42, Mass.

Equilibrium swelling data for vulcanizates of a group of rubbers in several different swelling media, with comparisons of the effects of various fillers; and an analysis of bound rubber and cross-link density in styrene rubber.

PLUS A R/A SPECIAL INDUSTRY REPORT

Profits and Overhead in the Rubber Industry.

A realistic aprpaisal of the increasing selling, general and administrative expenses in the rubber industry and how they are affecting profits, with figures for the last years which indicate the need for an objective evaluation of operating costs.

Rubber-Marlex 50 Polyethylene Blends

A new linear polyolefin offers significant advantages in compounding rubber stocks for numerous applications

By H. E. RAILSBACK and R. C. WHEAT

Research Division, Phillips Petroleum Co., Bartlesville, Okla.

MARLEX 50 polyethylene, the new linear polyolefin developed by Phillips Petroleum Co. research, has been studied extensively as an additive to rubber. It has been shown that this polyethylene imparts a greater degree of reinforcement to unfilled rubber vulcanizates than either high pressure polyethylene or high styrene resin.

The inclusion of small amounts (up to 10 parts) of Marlex 50 polyethylene in tread compounds containing 30 parts of black produces rubber which gives approximately equal wear in actual service (retread tires) compared to a conventional tread stock containing 50 phr of HAF black. A preliminary factory trial has confirmed the excellent hysteresis properties shown in the laboratory. Some cracking was encountered in tires on an indoor test wheel and the stocks did not process as easily as normal tread stocks.

It has been shown that Marlex 50 polyethylene is superior to high styrene resin as an additive in shoe sole compounds. In this type of formulation, Marlex 50 polyethylene imparts better stress-strain properties and better laboratory abrasion resistance than high styrene resins.

The dimensional stability (cold flow) of compounded uncured butyl rubber tube stocks has been improved by the use of small quantities (1 to 5 parts) of Marlex 50 polyethylene. Physical properties and processing characteristics of the vulcanizates were not significantly altered. Incorporation of small amounts of this polyethylene in raw rubbers should reduce the tendency to creep or flow during storage.

In addition to the applications mentioned, preliminary evaluations indicate rubber-polyethylene blends should offer advantages in gasket stocks, floor tile, mechanical rubber goods and blown sponge. The results obtained to date in laboratory studies indicate there are numerous applications where blends of rubber and Marlex 50 polyethylene should offer significant advantages over those obtained with conventional compounds used today.

RUBBER-RESIN blends have been studied by various investigators in an effort to obtain physical properties better than those of gum rubber stocks *(1, 2, 3, 4)*. Development of a low pressure process (by Phillips Petroleum Co. research) for the production of a new family of polyolefins has made available additional resins for evaluation in rubber.

Preliminary tests indicated Marlex 50 polyethylene type resin could be blended with all commercial synthetic elastomers. Although hysteresis and Shore hardness of styrene rubber gum stocks were increased as a result of adding Marlex 50 polyethylene to the rubber, the reinforcing effect of the resin, improvement in tensile properties and decrease in the hydrogen permeability of the vulcanizates were of interest.

Comprehensive studies of the properties of polyethylene-rubber blends, both gum stocks and pigment reinforced compounds of various types, were undertaken with the object of developing superior vulcanizates for a variety of applications. It is the purpose of this report to review the results of these investigations and present typical properties of the compounds developed to date.

Typical properties of Marlex 50 polyethylene are compared with those of conventional high pressure polyethylene below:

	Marlex 50 Polyethylene	High Pressure Polyethylene
Softening Temperature, °F.	260.0	222.0
Density	0.96	0.92
Melt Index	0.6	1.8
Heat Distortion Temperature, °F. (66 psi)	165.0	110.0
Tensile, Injection Molded, psi	5100.0	2050.0
Tensile, Compression Molded, psi	4200.0	1900.0
Elongation, Injection Molded, %	28.0	100.0
Hardness, Shore D	65.0	50.0

The test procedures used in obtaining the above data are listed elsewhere in this report. The basic compounding recipes used in the various studies are shown together with data on the stocks under the respective headings. The data have been organized into sections and are abbreviated for clarity.

TABLE I—COMPARISON OF RESINS IN GUM STOCKS

BASIC TEST RECIPE

Philprene 1500 Rubber	100.0
Resin Additive	0 or 20
Zinc Oxide	3.0
Stearic Acid	2.0
Flexamine	1.0
Sulfur	1.75
Santocure	1.5

Resin	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	200°F. Tensile (psi)	ΔT (°F.)	Resilience (%)	Shore A Hardness	Mooney MS-1½ at 212°F.	Permeability to Hydrogen* (Q)
None	19.0	180	230	400	100	27.1	78.1	33.0	25.5	270
Marlex 50 Polyethylene	18.2	540	1380	640	310	36.8	76.7	47.5	29.0	150
DYNH	27.6	350	900	650	160	38.1	77.7	44.0	27.0	211
Pliolite S-6	19.8	570	1280	495	110	52.7	75.8	47.0	25.5	210

*H_2/M²/day/cm. thickness at 0°C. at 1 atm. differential pressure.

Properties of Rubber-Marlex 50 Blends

Comparison with other resins. Initial studies or Rubber-Marlex 50 polyethylene blends were designed to determine if mixtures of this type would display unusual or unique physical properties that could not be obtained with other resins. Resins selected for comparison were conventional high pressure polyethylene and a high styrene resin.

The data shown in Table I established that Marlex 50 polyethylene, at the level used, conferred a significant degree of reinforcement to rubber. Comparison to stocks containing DYNH polyethylene indicate a considerable improvement in tensile strength, and gas permeability was obtained with Marlex 50 polyethylene with very little sacrifice in hysteresis properties. Although the vulcanizate containing the high styrene resin (Pliolite S-6) gave stress-strain properties similar to those of the stock reinforced with Marlex 50 polyethylene, the latter imparted much lower heat build-up and hydrogen permeability.

Effect of mixing temperature. In the earliest studies of Marlex 50 polyethylene-rubber blends it was observed that compression set and Mooney values were rather erratic. It was also noted that some of the stocks were more pliable than others. Since the polyethylene was always added to the rubber in a hot mix (270 to 300°F.) and mixing temperatures were difficult to control, it was considered advisable to study various mixing procedures to determine the effect on the physical properties. The stocks shown were compounded using 30 phr polyethylene in Philprene 1500 rubber. Properties of these stocks are shown in Table II.

The mixing temperature had a considerable effect on the physical properties of the compounded stocks. Since a final cold remill gave lower Mooney compounds which exhibited appreciably better physical properties than when hot mixing was used, Banbury and mill mixing cycles were standardized so that in both remills the stocks would be kept as cold as possible by circulating 60 to 70°F. water through the mill rolls or Banbury jacket. Typical mixing cycles are described below and in Table III:

(1) Roll Mill Mixing. Rubber is banded on a mill having a roll temperature of 270 to 300°F. Polyethylene is added to the rubber and milled until blended. Black and other compounding ingredients, except curatives, are added on the hot mill. The stock is sheeted off and allowed to cool and rest a minimum of one hour.

For remills, the stock is banded on a roll mill with cold water (60 to 70°F.) circulating through the rolls. Curatives are added and the stock is given two tight passes at hand tight gage. The stock is cut six times from alternate sides and rolled three times, the end of the

TABLE II—EFFECT OF MIXING PROCEDURE ON PHYSICAL PROPERTIES OF RUBBER-MARLEX 50 POLYETHYLENE BLENDS

Initial Mix	1st Remill	2nd Remill	300% Modulus (psi)	Tensile (psi)	Elongation (%)	ΔT (°F.)	Resilience (%)	Shore A Hardness	Compounded Mooney MS-1½ at 212°F.	Permeability to Hydrogen (Q)
Hot	Cold	Cold	680	1230	620	53.7	69.6	54	33.0	112
Hot	Hot	Cold	620	1510	690	49.3	68.6	54	34.0	163
Hot	Hot	Hot	660	1475	700	71.3	63.2	61	58.5	254

TABLE III—TYPICAL MIXING SCHEDULES OF RUBBER-POLYETHYLENE BLEND STOCKS

ROLL MILLS

	Minutes
Breakdown	2
Polyethylene addition	10*
Black, softener and other compounding ingredients	8
Cutting	2
Rolling	1
Total	23

2 Remills—5 minutes each

BANBURY

Rubber and polyethylene	0
Half of black and half chemicals except curatives and softener	2½*
Balance of black and chemicals except curatives and softener	3¼
Softener	4
Dump, sheet off immediately	5½

Total mixing time—5½ minutes
2 Remills—5 minutes each

*Adjust as necessary to thoroughly blend the rubber and plastic.

roll being inserted into the mill. The stock is sheeted off and allowed to cool for a minimum of one hour. The procedure is repeated for a second remill.

(2) Banbury Mixing. The rubber, polyethylene, carbon black and other compounding ingredients, except curatives, may be mixed initially in a Banbury, if desired. Conditions should be adjusted to give a dump temperature of 270 to 300°F. for the initial mix. Addition of curatives and remills should be accomplished as described in the roll mill procedure.

Effect of polyethylene level. Since Marlex 50 polyethylene imparted a measurable degree of reinforcement to gum stocks at the 20 phr levl, it was considered that other loadings might give an even more interesting balance of physical properties. The basic compounding recipe used was identical to that given in Table I, except for the variation in polyethylene level. Data showing the physical properties of a typical styrene rubber gum stock are repeated in Table IV for convenience in making comparisons.

Compounding the rubber-polyethylene blends in identical recipes, except for the increase in Marlex 50 polyethylene level, resulted in a consistent trend toward better stress-strain properties and lower permeability to hydrogen. Shore hardness and Mooney values increased and hysteresis properties were adversely affected as the polyethylene loading was increased. Although the trend is not well defined, compression set values were highest for the stock containing the largest amount of resin. In many applications where white or bright colored stocks are desired, the physical properties of compounds of this type should be of considerable interest.

Comparison with other polyethylene type resins. Blends of rubber with Marlex 50 polyethylene and a conventional polyethylene (DYNH) are compared at the 30 phr level in Philprene 1500 gum compounds in Table V. The basic compounding recipe used was identical to the formulation shown in Table I.

Physical properties at elevated temperatures. Since the blends discussed previously were prepared with vulcanized rubber and a thermoplastic resin and since many applications require reasonably good tensile properties at elevated temperatures, the effect of temperature on the properties of these blends was determined. Figures 1 and 2 depict the effect of testing temperature on the stress-strain properties and Shore hardness of rubber-resin blends containing 30 phr of polyethylene.

The Marlex 50 polyethylene-Philprene 1500 blends gave a much better retention of physical properties than blends of conventional polyethylene with this rubber. Even at 200°F., the Marlex 50 polyethylene blends gave better stress-strain properties than the gum stock at room temperature.

Carbon Black in Rubber-Marlex 50 Compounds

Variable black loadings. In view of the reinforcement obtained with Marlex 50 polyethylene in gum compounds, various loadings of carbon black were investigated in these rubber-resin blends. Increased black loadings resulted in trends toward improved stress-strain properties and resistance to abrasion, increased heat build-up, hardness and compounded Mooney.

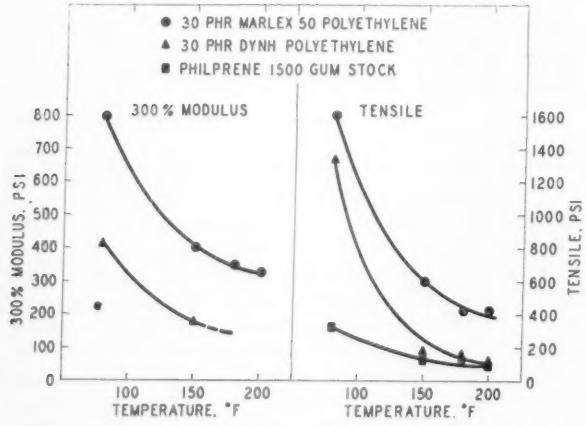

FIG. 1—Effect of temperature on modulus and tensile strength of rubber-polyethylene blends.

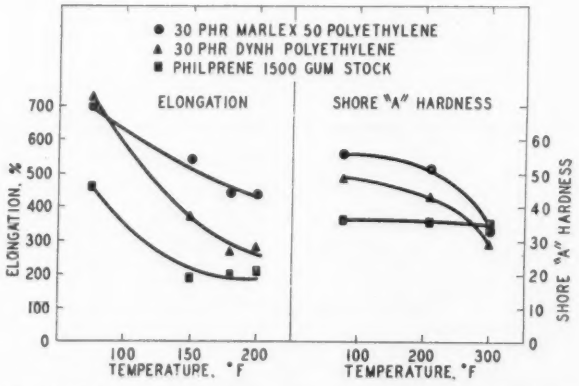

FIG. 2—Effect of temperature on elongation and Shore A hardness of rubber-polyethylene blends.

The data shown in Table VI indicate that by the use of this type of polyethylene it is possible to reduce the black level and obtain significant advantages in heat build-up without seriously affecting other physical properties, as compared with those of a conventional tread stock. These blends should be of value in applications where heat generation is critical.

One of the features of these blends which has received considerably study is the shrinkage of extruded stocks. The data in Table VI show the effect of extrusion temperature and black loading on the shrinkage of rubber-polyethylene blends.

At extrusion temperatures above the softening point of Marlex 50 polyethylene (260°F.), this polyolefin does not alter the shrinkage of compounded stocks to any great degree. At extrusion temperatures below this softening point, however, the plastic reduces the shrinkage of the stocks in a manner similar to conventional reinforcing agents.

Various polyethylene levels in black reinforced stocks. Cold rubber-HAF black stocks containing various levels of Marlex 50 polyethylene were studied to determine the effect of the loading on the physical properties of the vulcanizates. The data in Table VII indicate that in-

TABLE IV—EFFECT OF VARIOUS LOADINGS OF POLYETHYLENE IN PHILPRENE 1500 GUM STOCKS

Marlex 50 Polyethylene (phr)	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	ΔT (°F.)	Resilience (%)	Shore A Hardness	Mooney MS-1½ at 212°F.	Permeability to Hydrogen (Q)
None	19.0	180	230	400	27.1	78.1	33.0	25.5	270
10	24.8	240	670	530	33.8	78.0	38.0	26.5	232
20	18.2	540	1380	640	36.8	76.7	47.5	29.0	156
30	21.6	730	1660	700	44.6	73.9	56.0	33.5	141
40	32.1	840	2050	810	53.7	70.4	64.0	39.0	115

TABLE V—COMPARISON OF EFFECTS OF MARLEX 50 AND DYNH POLYETHYLENE ON A PHILPRENE 1500 GUM COMPOUND

Polyethylene Type	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	ΔT (°F.)	Resilience (%)	Shore A Hardness	Mooney MS-1½ at 212°F.	Permeability to Hydrogen (Q)
Marlex 50	21.6	730	1660	700	44.6	73.9	56	33.5	141
DYNH	30.7	460	1080	600	42.2	74.0	51	33.5	211

TABLE VI—EFFECTS OF VARIOUS BLACK LOADINGS IN RUBBER-POLYETHYLENE BLENDS

RECIPE

Philprene 1500 Rubber	90 / 100
Marlex 50 Polyethylene	10 / —
Philblack O	variable / variable
Zinc Oxide	3 / 3
Stearic Acid	1 / 1
Flexamine	1 / 1
Circo-Para	10 / 10
Sulfur	1.75 / 1.75
Santocure	variable / variable

Rubber (parts)	Marlex 50 Polyethylene (parts)	Philblack O (parts)	Santocure (parts)	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	Δ T (°F.)	Resilience (%)	Shore A Hardness	Mooney MS-1½ at 212°F.	Extrusion Shrinkage at 250°F. (%)	Extrusion Shrinkage at 280°F. (%)
90	10	30	1.5	19.1	1100	3050	595	47.9	66.3	58.0	30.5	55.3	70.1
90	10	35	1.4	19.1	1300	2810	540	51.3	64.7	60.5	33.0	50.2	68.1
90	10	40	1.35	20.3	1575	2990	500	57.1	62.4	63.5	36.0	46.0	65.0
100	—	30	1.5	17.7	690	2550	600	43.6	69.8	48.5	24.0	66.6	69.7
100	—	40	1.35	18.8	1075	3175	605	53.0	64.3	54.5	28.0	61.7	66.0
100	—	50	1.2	19.1	1460	3330	560	62.8	60.2	58.5	32.0	55.1	59.4

Table VII—Effects of Polyethylene Level on Physical Properties of Black Reinforced Stocks

RECIPE

Philprene 1500 Rubber	100.0
Marlex 50 Polyethylene	variable
Philblack O	30.0
Zinc Oxide	3.0
Stearic Acid	1.0
Flexamine	1.0
Circo-Para	10.0
Sulfur	1.75
Santocure	1.5

Philblack O (parts)	Marlex 50 Polyethylene (parts)	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	ΔT (°F.)	Resilience (%)	Shore Hardness	Mooney MS-1½ at 212°F.	Extrusion at 250°F. in./min.	Extrusion at 250°F. g./min.
30	—	16.6	720	3320	690	42.6	70.1	50.0	25.0	32.2	104.5
30	5.0	15.9	780	2700	615	45.6	68.6	51.5	25.5	32.2	101.0
30	7.5	15.6	825	2720	625	47.9	67.8	52.5	26.0	32.8	99.2
30	10.0	16.7	875	2900	650	48.7	67.2	54.5	26.5	35.0	100.8
30	12.5	17.1	920	3125	675	49.7	66.8	54.5	29.0	33.8	93.2
50	—	20.3	1420	3510	580	62.8	61.2	60.0	34.5	43.0	107.0

Table VIII—Effects of Various Carbon Blacks in Rubber-Marlex 50 Polyethylene Blends

RECIPE

Philprene 1500 Rubber	90.0
Marlex 50 Polyethylene	10.0
Black	30.0
Zinc Oxide	3.0
Stearic Acid	1.0
Flexamine	1.0
Circo-Para	10.0
Sulfur	1.75
Santocure	1.5

Philblack	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	ΔT (°F.)	Resilience (%)	Shore Hardness	Mooney MS-1½ at 212°F.	Extrusion at 250°F. in./min.	Extrusion at 250°F. g./min.
A	18.6	1070	2360	590	44.6	69.5	58.0	29.0	43.2	101
O	17.9	1075	2790	585	46.6	67.2	58.5	27.5	37.8	96
E	18.4	1020	3600	650	52.1	61.3	62.0	33.0	32.0	82

Table IX—Effects of Various Curing Systems on Rubber-Marlex 50 Polyethylene Blends

Santocure (parts)	NOBS Special (parts)	DPG (parts)	A-32 (parts)	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	Δ T (°F.)	Resilience (%)	Mooney Scorch at 280°F.
1.1	—	—	—	25.8	1030	3010	630	47.9	68.0	35.0
1.5	—	—	—	17.9	1075	2790	585	46.6	67.2	31.0
1.3	—	0.52	—	14.6	1110	2730	570	44.9	66.4	22.5
—	1.3	0.52	—	16.3	1130	2450	525	43.3	68.2	33.5
1.0	—	—	0.2	15.0	1225	3040	575	49.0	68.7	15.5

creased polyethylene content results in greater reinforcement as judged by modulus, heat build-up, hardness and compounded Mooney values.

A comparison of the properties of these vulcanizates with those of compounds from other sections of this report imply that the advantages of these blends are realized when stocks were compounded on a basis of 100 parts rubber or when Marlex 50 polyethylene replaced a portion of the rubber. For this reason, in subsequent studies the rubber-polyethylene-black stocks were compounded in such a manner that the polyethylene was substituted for a portion of the rubber.

Effect of various blacks on properties of blends. Various carbon blacks were investigated in rubber-resin blends to see if the expected trends toward higher tensile, poorer hysteresis and extrusion characteristics and better laboratory abrasion resistance would be obtained as the reinforcing potential of the blacks increased. It is apparent from the data in Table VIII that by the proper selection of black, the advantages of the rubber-Marlex 50 polyethylene blends can be realized while obtaining the reinforcement of the particular black. The exceptionally good hysteresis properties of these blends should be noted.

Effects of various accelerators. In many instances, improved physical properties are obtained by using different curing systems in rubber vulcanization. Although no scorch or processing problems had been observed with rubber-polyethylene stocks, it was decided to determine if any advantages could be realized by using one of the commercial delayed action accelerators in common use or if accelerator levels could be reduced by employing "kickers" or secondary accelerators. Data are given in Table IX. The basic compounding recipe was identical to that shown in Table VIII except as noted.

Increasing the Santocure level from 1.1 to 1.5 parts reduced compression set slightly and gave the expected effect on modulus and hysteresis. A "kicker" or secondary accelerator such as diphenylguanidine gave even tighter cures and better hysteresis properties; however, scorch resistance was adversely affected. In combination with NOBS Special, this secondary accelerator imparted a good balance of physical properties but tensile values appeared to be slightly low. A-32 also imparted low compression set and high modulus when used in combination with Santocure, but scorch resistance was the poorest of the group tested.

These data indicated that various accelerator systems might be used successfully in Philprene 1500-Marlex 50 polyethylene blends but that a single primary accelerator is satisfactory for obtaining a good over-all balance of properties and little is to be gained with the other systems tried.

Recap tire test. Inasmuch as Marlex 50 polyethylene imparted reinforcement to gum compounds and because the rubber-polyethylene-black blends displayed better hysteresis properties than a conventional tread compound, a blend of this type was evaluated in a recap tire test. Table X shows the results of this recap test, in

TABLE X—RESULTS OF RECAP TIRE TEST ON PHILPRENE 1500-MARLEX 50 POLYETHYLENE-PHILBLACK O STOCK

Ratio*	Miles	Miles/.001"	Tread Rating
90/10/30	9277	60	94
100/—/50		64	100
90/10/30	9312	85	104
100/—/50		83	100
90/10/30	9382	77	111
100/—/50		69	100

*Ratios signify parts of Philprene 1500-Marlex 50 polyethylene-Philblack O, respectively.

Test Procedures

RUBBER COMPOUNDS

Compression Set—ASTM D-395-55, Method B, modified (0.325-inch spacers), two hours at 212°F. plus relaxation for one hour at 212°F.

Tension Tests—ASTM D-412-51T, Scott Tensile Machine, L-6. Tested at designated temperature.

△T, °F., Heat Build-up—Goodrich Flexometer, 143 lb./sq. inch load, 0.175 inch stroke. △T equals rise in temperature above 100°F. oven in 15 minutes.

Resilience—ASTM D-945-55, modified, Yerzley Oscillograph. Test specimen, right circular cylinder 0.70 inch diameter and 1.0 inch height.

Shore A Hardness—ASTM D-676-55T, Shore Durometer, Type A.

Abrasion—Modified Goodyear-Huber Angle Abrader.

Mooney Scorch—ASTM D-1077-55T, Mooney Viscometer, large rotor. Scorch is minutes to 5 point rise above minimum Mooney.

Compounded Mooney—ASTM D-927-55T, Mooney Viscometer, small rotor, 212°F., 1.5 minutes.

Extrusion—No. ½ Royle Extruder with Garvey die. See *Ind. Eng. Chem.*, Vol. 34, p. 1309 (1942).

Permeability—Determined using a Cambridge Fabric Permeameter S.O. #344266. Sample thickness 0.020-0.025 inch. Permeability is given as cubic centimeters of hydrogen through a membrane one square meter in area, one centimeter thick in twenty-four hours at one atmosphere pressure.

PLASTICS

Melt Index—ASTM D-1238-52T.

Heat Distortion Temperature—ASTM D-648-45T.

Tensile and Elongation, Injection Molded—ASTM D-638-52T, pulled at 20 inches/minute.

Tensile, Compression Molded—ASTM D-412-51T, pulled at 20 inches/minute.

Table XI—Effects of Various Loadings of Marlex 50 Polyethylene in Shoe Sole Stocks

RECIPES

Philprene 1503 Rubber	100.00
Additive	variable
Zinc Oxide	5.00
Hi-Sil	65.00
Cumar MH-2½	13.20
E-S-E-N	0.50
Diethylene Glycol	3.00
Circolight Oil	9.00
Stearic Acid	1.60
Agerite Superlite	1.50
Titanium Dioxide	4.25
Red Iron Oxide	2.60
Philblack A	0.05
MBTS	1.50
Tuads	0.75
DPG	1.45
Sulfur	2.00

Additive	Amount of Additive (phr)	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	200°F. Tensile (psi)	Tear Resistance (lb./in.)	Shore Hardness	NBS Abrasion (rev./mil.)
Marlex 50 Polyethylene	20	9.0	1100	1940	485	580	200	68.0	3.47
	30	11.6	1170	2250	510	660	255	71.5	4.10
	40	11.9	1370	2160	480	1050	300	83.0	5.10
	50	14.4	1210	2140	525	1000	325	82.0	5.16
Marbon 8000A	50	5.2	1340	1880	435	540	280	88.5	2.67
Pliolite S-6	50	8.9	1430	1670	380	670	265	89.0	2.53

Table XII—Comparison of Polyethylene as Stiffening Agents in Butyl Rubber Tube Stocks

RECIPE

Butyl Rubber (GR-I-17)	100.0
Philblack A	50.0
Marlex 50 Polyethylene	variable
DYNH Polyethylene	variable
Paraffin wax	1.0
Zinc oxide	5.0
Stearic acid	1.0
Forum 40 oil	20.0
Sulfur	1.0
Captax	0.5
Tuads	1.0

Polyethylene (phr)	Compression Set (%)	300% Modulus (psi)	Tensile (psi)	Elongation (%)	ΔT (°F.)	Resilience (%)	Shore Hardness	Mooney MS-1½ at 212°F.	Extrusion at 280°F. in./min.	Extrusion at 280°F. g./min.	Sag* (%)
MARLEX 50 POLYETHYLENE											
1.0	19.3	590	1830	700	45.3	65.8	50	27.5	45.0	78.0	15.6
2.5	20.3	610	1770	690	44.6	65.3	51	26.0	47.5	79.0	9.9
5.0	20.4	630	1840	705	47.6	64.1	56	29.0	45.0	76.2	3.0
10.0	20.4	675	1850	710	50.7	62.8	59	34.5	37.8	69.5	1.1
DYNH POLYETHYLENE											
1.0	18.7	570	1800	705	43.9	66.6	51.0	26.0	49.2	82.2	16.5
2.5	19.4	575	1890	730	43.9	66.1	52.0	27.5	44.8	81.2	14.0
5.0	19.8	580	1710	700	44.9	65.2	52.5	26.0	48.2	80.8	11.2
10.0	21.5	625	1740	700	46.3	64.9	55.0	27.0	45.2	79.5	3.9
NONE											
0	20.0	610	1730	680	42.2	67.0	51	26.5	50.8	80.5	22.7

*Based on increase in length of uncured specimen extruded through 3/16 inch diameter round die, supported at one end and allowed to hang freely for 8 hours.

which a 90/10/30 rubber-polyethylene-HAF black stock was compared to a standard cold rubber tread control. The compounding recipe used for the experimental stock was identical to that shown in Table VIII.

This 90/10/30 blend is of interest since it displayed essentially equal tread wear and, as previously pointed out, has a lower heat build-up than the control. An identical blend in a whole tread tire, run on a test wheel, displayed approximately 10 degrees lower running temperature in the shoulder of the tread, while the contained air temperature was about 30 degrees cooler than that of a control tire. The tire was removed at 5564 miles because of excessive cracking after operating at an overload rating of up to 160 per cent.

Applications of Marlex 50 Compounds

Since it is common practice in industry to use resins to increase the hardness of shoe sole compounds *(5, 6)*, Marlex 50 polyethylene was evaluated at various loadings in stocks of this type. These compounds have been compared to stocks containing high styrene resins. The data are presented in Table XI.

Marlex 50 polyethylene, at an equal loading, imparted better stress-strain properties and abrasion resistance and slightly softer vulcanizates than was realized by the use of high styrene resins. The vulcanizates containing polyethylene also displayed significant advantages in cracking when hand flexed. Interest in this linear polyethylene has been expressed by shoe manufacturers, and the material should find many applications in the shoe industry.

Cold flow or creep of raw rubbers and uncured, compounded stocks often cause handling and processing difficulties to manufacturers and consumers of rubber and rubber products. Marlex 50 polyethylene, in small amounts, has been incorporated into butyl rubber tube stocks and compared to compounds containing high pressure polyethylene as a stiffening agent. It was found that up to 5 phr of Marlex 50 polyethylene in these stocks markedly reduced the sag of these compounds with very little change in physical properties.

The results shown in Table XII and Figure 3 indicate that the linear polyethylene is approximately twice as effective as high pressure polyethylene as a stiffening agent in compounded butyl rubber tube stocks. Although standard testing procedures for the determination of cold flow of raw rubbers have not been established, these data indicate incorporation of small quantities of Marlex 50 polyethylene in raw rubbers should reduce the tendency of the rubber to flow during storage.

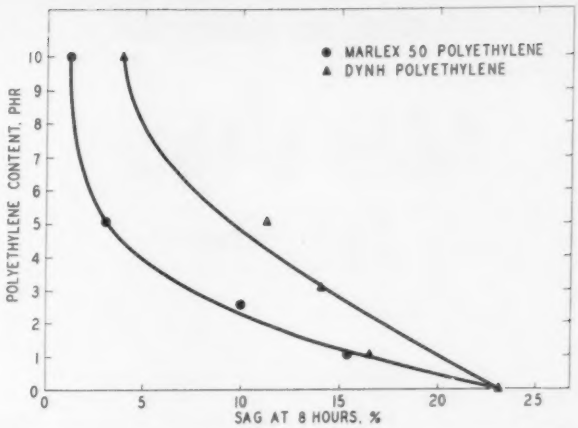

FIG. 3—Comparison of polyethylenes as stiffening agents in butyl rubber tube stock.

In addition to the applications of rubber-Marlex 50 polyethylene blends described in this report, preliminary evaluations indicate these blends should offer advantages in such rubber items as: gaskets, to provide lower hydrogen permeability and improved resistance to solvents; floor tile, to impart improved impact strength; and blown sponge, to give greater tear resistance and lower permanent set. Undoubtedly, there are many other potential applications for blends of this nature which will be brought to mind by the data presented in this report.

ACKNOWLEDGMENT

The authors wish to express their sincere appreciation to Dr. P. G. Carpenter, under whose direction a part of this work was conducted.

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Dill Tubeless Tire Valve

► A new clamp-in valve for tubeless tires, Number VS 902B-R, has been announced by the Dill Manufacturing Co., 700 East 82nd St., Cleveland 3, Ohio. Used with the correct washer and one of three extensions, it will fit any size valve rim hole in both 14 and 15 inch passenger car rims. A dealer can use the valve in taking care of any tubeless tire valve replacement job without undue stocking of valves in various sizes. The valves come packed one to an envelope, five envelopes to a box, or in 50 unit lots.

Richardson Counter and Totalizer

► A newly developed counter and totalizer enables processors to maintain an accurate inventory check on each ingredient being fed into a proportioning system according to Richardson Scale Co., Van Houten Ave., Clifton, N. J. The new unit records the weight of each individual ingredient used during any batch or during any required time interval, and also totals the weight of all ingredients used. Sizes are available for recording up to a hundred ingredients, keeping an inventory record on as many as are used in a particular operation.

Questions and Answers on

Rubber-to-Metal Adhesion

What a symposium audience wanted to know; and how the experts answered

FIVE papers on "Rubber-to-Metal Adhesion" presented at the October 25, 1957 meeting of the Akron Rubber Group appeared in the December, 1957 issue of RUBBER AGE. They were delivered at a panel discussion in which the following speakers participated: Ralph P. Schmuckal, Ford Motor Co., Detroit, Mich.; F. W. Gage, Dayton Chemical Products Laboratories, Inc., West Alexandria, Ohio; Russell E. Sawyer, R. T. Vanderbilt Co., Inc., New York, N. Y.; Peter J. Larsen, Lord Manufacturing Co., Erie, Penna., and Howard H. Irvin, Marbon Chemical Division, Borg-Warner Corp., Gary, Ind. J. Hugh Macey, Goodrich Research Center, Brecksville, Ohio, served as moderator of the discussion.

After the speakers presented their papers, they answered questions submitted by members of the audience. Herewith is a transcript of what the listeners asked about rubber-to-metal bonding, and what the panelists had to say in reply:

Question: If and when failure occurs in an engine mount why do we sometimes see perfectly clean separation of the rubber from the metal in certain large areas and good adhesion with failure in the rubber in other areas of the same part? Is there some other not-so-clearly-understood phenomenon at work here?

Answered by Mr. Gage: In Mr. Schmuckal's opening remarks, he mentioned that one reason is lack of proper care being taken to get the bond, but I think there is something a little more basic than just lack of care. One thing that occurs to me is that the bonding system does not have enough intrinsic adhesion. In other words, the bonding system does not have enough insurance or additional bonding properties to overcome the possible variables that might be introduced through certain periods of operation. That is, there are known periods of operation when variables are in control and the bonding system is adequate to give proper bond; but, when variables get out of control, as they often do in bonding operations, if the adhesion system does not have sufficient intrinsic adhesion or additional insurance, then the bond will not be as good as it should be. I will limit it to that.

Question: Do we have a problem of the prime coat slipping from certain portions of the metal during molding operations, particularly on more complex shapes where difficult flow patterns are encountered? If so, which primers (and interface materials) are least subject to such slippage?

Answered by Mr. Irvin: As for primers, primarily there is a set pattern in transfer molding where stock has to travel a certain path under a fair amount of pressure. The best way to overcome this is to make sure that the primer coat is perfectly dry and set.

Answered by Mr. Sawyer: In compression molding, preparation can be minimized by preforming the stock approximately to the size and shape of the insert. This will minimize the effects of stock blow and variation in stock grain. If you have a problem, check with your supplier.

Question: Is volatilization of highly loaded oil stocks prior to cure a problem in getting adhesion?

Answered by Mr. Irvin: The oil that is used in the manufacture of oil-extended styrene polymers is of the heavy duty type. This is put in the polymer so as not to interfere with adhesion. In regard to possible failure of these oils, that is no problem because the vapor pressure of these oils is low enough that by evaporation and subsequent condensation the surface would be dry, and bonding is no problem.

Question: What progress is being made in improving bond strengths of butyl rubber to allow high stress loads under vibratory conditions?

Answered by Mr. Larsen: The bonds obtained with butyl rubber are not as good as those obtained with other polymers, but we do have vibratory conditions to take into consideration. On properly designed parts, we do not have any difficulty with bond failures. You can perhaps say that the techniques and adhesion requirements are adequate for the designed part. The bonding strength sometimes depends upon the strength of stock. If you are having trouble, see your supplier.

Question: What is considered the best method for evaluating a bond? What tests and time elements do you use for comparative bond evaluations?

Answered by Mr. Larsen: I do not believe you are going to have vibratory failure under dynamic conditions unless you also have a failure when testing under the ASTM Method provided it is not a low quality stock that will not show a failure on ASTM Method B. ASTM Method B had not yet been modified to include the effects of temperature, and we do not have a satisfactory answer.

Question: What may be considered a safe waiting period after manufacture to evaluate and approve a bond?

Answered by Mr. Larsen: Assuming that we have proper compounding technique and bonding procedures, the customer should be able to spot check immediately. If the bond is satisfactory at that time, he should be able to assume that it will last a reasonable length of time in service.

Question: Is it possible to accelerate the deterioration of a bond that normally occurs with shelf aging? Do high humidity or high temperature aging conditions speed up the breakdown?

Answered by Mr. Larsen: The answer to first part of question is yes. There should be the possibility of setting up a control test which can involve the use of a satisfactory part as a standard on the high humidity, high temperature, and stress test, and then relating incoming production to the results obtained. Any such test should be used with a great deal of discretion.

Question: Is it possible that some day we may replace the vulcanized bond with cold-set adhesives?

Answered by Mr. Irvin: There has not been too much consideration given to the problem because it is not economically feasible to obtain vulcanization of the stock and adhesion at the same time. In certain cases, it would be possible. There are adhesives available which give some degree of bond to a vulcanized stock.

Question: Are you prepared to give us double present day bond strengths with urethane rubber?

Answered by Mr. Gage: There are cements available that will give satisfactory bonds with polyurethane rubbers in which the strength of the bond is equal or greater than the strength of the polyurethane stock.

Question: What is the method or methods and what is the mechanism of adhesion of wire to rubber in tires?

Answered by Mr. Macy: The mechanism of adhesion of wire to rubber in tires is no different from that in other adhesion systems. The methods involved are somewhat different, due in part to different conditions dictated by the product and in part to the differences in thinking of tire people as compared to that of mechanical goods people.

As far as the wire itself is concerned, it is best to use wire with either a light oil coating or no surface protection and to avoid the heavy drawing soaps which may be present on wire and which present very difficult cleaning problems in preparation for adhesion. Beyond this, the adhesion depends on whether single wire or multiple standard wire is used. With single bare wire of steel composition, the problem is similar to normal bonding. If the steel contains high nickel, the problem may be similar to stainless steel bonding. In such cases, pickling of the metal and regular bonding cements would produce good adhesion, if the producer can stand the costs involved.

Alternatively, the French method of compounding the tire carcass stock, by using high metal soap content to produce direct adhesion to steel, will work. If copper flash or zinc-copper coating on the wire is used, the adhesion problem may become similar to compounding for brass plate adhesion. Best results would probably be given by brass plating the wire and compounding for direct adhesion to brass.

If multiple stranded wire is used, the problem is complicated by surface effects, and this applies likewise to large wire cables used in other products. Here, the surface tension causes thinning of cement applied to the stranded wire on the outer surface of the strands and thick spots and bridging at the contact points of the strands so that poor adhesion is produced, both at the thin spots and, due to splitting of the primers, in the thick spots. Good adhesion results only on the shoulders of the strands. Here again, best results can be achieved by brass plating the stranded wire and compounding for direct adhesion to brass.

Question: Discuss technique for adhesion of butyl rubber to brass plate for airbags. Type of cement? Is there any surface better than brass plating?

Answered by Mr. Sawyer: In answering this question, we assume that you are referring to valves for airbags. If any progress has been made in the development of chemically-bonded butyl rubber valves for airbags, we are not familiar with it. There has been some success with a totally mechanical valve. Steel would provide a better bonding surface than brass plate. However, since corrosion is a factor, its use would not seem to be practical for this application.

Answered by Mr. Larsen: We have not had much experience bonding butyl rubber to brass plate, so we would not necessarily be qualified to discuss this situation at any length. However, I believe we can say that if we had to adhere butyl rubber to brass plate, there are adhesives available and we would anticipate no problems. The technique would be straightforward with no particular deviation. There are metals more easily bonded, such as steel, aluminum and stainless, if these would fill other requirements.

Answered by Mr. Gage: It is our understanding that butyl rubber is being bonded to brass plate for air bags with commercially available booster coats designed for this service.

Question: What is the best adhesive for high temperature butyl rubber-to-steel and butyl rubber-to-aluminum bonding? What is the best curing system for butyl rubber to obtain maximum adhesion to metal (high temperature)?

Answered by Mr. Sawyer: By high temperature we assume that the writer is referring to temperatures in the range of 350 to 400° F. We have received several reports that the commercial bonding agents presently available for butyl rubber will not stand up under these temperatures. The Amberol ST-137-metallic chloride cure system patented by U. S. Rubber Co. is probably the best acceleration system for butyl rubber compounds

that must operate in service at temperatures of 350 to 400° F. We do not know whether a compound accelerated with this system can be bonded to metal with either a phenolic or epoxy base primer or not. If satisfactory adhesion could be developed with a primer of this type, the service life of the assembly should be good under high temperature conditions.

Answered by Mr. Gage: Bonding high temperature butyl rubber compounds to metal has presented a somewhat difficult problem. However, there are bonding agents available that have shown some promise for this application. I would suggest you contact your supplier and let him give you a solution to this problem. The phenolic-metallic chloride curing system is probably the best for high temperature resistant stocks.

Answered by Mr. Larsen: I am not quite sure what is meant here, but if we mean vulcanizing butyl rubber at 375° F. while bonding to brass, again, we would use available adhesives and would anticipate no trouble. If we mean bonding the butyl rubber to brass so that it would withstand ambient temperatures of 375° F., this could be something of a problem, although for intermittant operation, assuming that the stresses were not too severe, this would be possible.

Question: What is the best curing system for butyl rubber to obtain maximum adhesion to metal (high temperature)?

Answered by Mr. Larsen: We are not in a position to indicate a best system, but a couple of acceptable ones are sulfur - Bethyl Tuads - Captax and sulfur - Thionex - Polyac. We have bonded to butyl rubber using these systems.

Question: What is the best adhesive for high temperature butyl rubber-to-steel and butyl rubber-to-aluminum bonding?

Answered by Mr. Larsen: Again, I'm not sure what is meant, but assuming that we mean a cement which can be used under conditions of high vulcanization temperatures to bond butyl rubber to steel and aluminum, there are several recommended ones on the market. We can only suggest that you try these as recommended by the supplier and check final results. Incidentally, the ASTM strip test would be a good medium to use for this investigation.

Question: What is the latest recommendation for adhering a butyl stock to metal, using tacky cements and open steam curing? Does the use of lead oxide curing systems affect adhesion?

Answered by Mr. Gage: It is difficult to say what would be the best recommendation for the application mentioned. So much depends on the type of stock being used, the conditions of cure, and the amount of tack required. With the risk of being repetitious, I would again suggest that you contact your supplier and let him give you a solution to the problem.

Question: What is the best adhesive for butyl-to-steel bonding when both metal and rubber flex?

Answered by Mr. Sawyer: Under these conditions, it is our opinion that the best results would be obtained by brass plating the steel and bonding the stock directly to the brass plate with the use of a cover cement.

Answered by Mr. Larsen: There are several proprietary adhesives recommended for butyl rubber bonding. We do not believe that flexing the butyl rubber will affect the bond. If some metal flexing or metal distortion is encountered, this could seriously impair the adhesion. We would recommend using the D-429 Method B sample to compare the available adhesives as to metal distortion resistance. The samples could be bonded and then bent in a controlled fashion. Stripping the rubber from the part should give you your answer.

Question: What is the best bonding agent for bonding sponge to metal? What is the best way to treat metals to which sponge is bonded?

Answered by Mr. Gage: Sponge rubber normally is not difficult to bond to metal. Any bonding agent capable of bonding a regular compound from the same base rubber should bond the sponge stock. By the same token, there is no "best" way to prepare the metal surface for bonding sponge. Grit-blasting, brass-plating, phosphatizing are all highly satisfactory if usual care is taken. However, the metal should be smooth, since contact between metal and rubber will be inadequate if the surface is rough, because of the low pressures involved.

Question: What is the best adhesive for Kel-F plastic to aluminum?

Answered by Mr. Irvin: Kel-F is a material which is difficult to bond, and to obtain a bond to aluminum is somewhat more difficult than obtaining a bond to steel. However, fair success has been possible with the use of certain epoxy adhesives.

Question: Please enumerate non-destructive tests that predict future failure of rubber-brass adhesion for use on tube and tire valves.

Answered by Mr. Larsen: I take it that "future failure" means service life, and I am assuming that we can mean any adhesion, whether it be rubber-to-brass or what have you. We may be a little bit behind the times, but we do not know of any non-destructive tests that can predict service life. The only true test by which service life can be ascertained is through exposure to the actual application and running enough such tests that a fairly accurate average can be obtained. The adhesion may well last longer than the rest of the tube.

The only thing that we can suggest is to determine the force necessary to destroy the bond and, then, on the control test, use a figure somewhat less. This is after having ascertained that the total force necessary to destroy the bond is well in excess of what might be expected in service. Also, the bond itself might be exposed to the extremes of environmental conditions, other than stress, that might be encountered in the service.

Any fall-off in adhesion value can be noted after this exposure. All of this would require adequate controls to make sure that constants are maintained in the operations, so that the actual part, the valve, accurately reflects the bond that has been obtained on a sample, such as the D-429 sample on which we have ascertained our standards.

Question: Does neoprene have any corrosive effects on metal in neoprene-to-metal adhesion? Is there any known adhesive system for natural rubber or neoprene to galvanize steel cable?

Answered by Mr. Sawyer: In answer to the first part of the question, the literature states that hydrogen chloride is evolved from neoprene under high temperature conditions. With moisture present, the acid formed will accelerate rusting in some applications. The use of acid acceptors such as magnesium oxide and zinc oxide are controls for this condition. It is known that plasticizers such as the esters and polyesters tend to promote rusting and should be avoided in bonding compounds. This subject was discussed more fully in my opening remarks.

The latter part of the question can be answered only in a general way. It is our opinion that the application will determine to a large extent whether it is practical. Such factors as the size, construction of the cable, and the adhesion required would also have to be specified. We believe neoprene would be the preferred elastomer. We have not had any experience with bonding to galvanized steel cable. However, we do know that with most of the commercially available bonding agents reasonably good adhesion to galvanized sheet metal is obtained. The adhesion is improved by pickling the galvanized metal in a 15 per cent phosphoric acid solution at 150° F.

Question: Is a two-coat adhesive system (primer for metal and cover cement) necessary for natural and styrene rubber compounds to secure good adhesion?

Answered by Mr. Irvin: This cannot be answered yes or no. As pointed out previously, certain compounds may require a cover cement because of particular circumstances, such as cure rate, plasticizer content and other factors.

Question: Is the metal primer in the previous question answered by Mr. Irvin completely polar? Does it contain curing ingredients? Is the cover cement a combination of both polar and non-polar materials based on a tread stock, such as a bogie roller wheel?

Answered by Mr. Gage: The most effective primers are polar in nature. They must be to develop a satisfactory bond to most metal surfaces. Bonds with brass plate are usually attributed to a bridging between stock and metal through a sulfur covalent type linkage, but those to other metals are developed mainly through other forces and the polarity of the primer is highly significant. On the other hand, cover coats are usually not as polar as primers, since they are designed to produce good adhesion to rubber stocks which are non-polar in nature, and therefore a high degree of polarity, if not required, is to be avoided.

Question: What are minimum cavity pressures recommended for good adhesion? What is the preferred method of metal preparation—chemical cleaning, such as a phosphate coating, or a grit blasting?

Answered by Mr. Sawyer: It has been suggested that the minimum pressure required is in the range of 1500 psi. Actually, however, the minimum pressure necessary to assure a dense, non-porous stock is usually sufficient for good adhesion.

It has been our experience that grit blasting is preferred to a phosphate coating not only for the economics but because the former gives a clean virgin metal to which better bonds are obtained. A phosphate coating is more resistant to rusting, but the process requires careful control in order to assure good adhesion of the coating to the metal. Also, the nature of the coating will determine how well the primer will adhere to it.

Question: How can rubber be made to adhere to a metal spring which is under constant flexing? What bonding agent is best for this purpose?

Answered by Mr. Larsen: To answer this question I am first going to assume that the flexing does not begin until after we have adhered the rubber to the metal spring. It would be a real trick to bond this spring, in action, to a piece of rubber. Depending upon the metal in the spring, there are a number of adhesives which would provide a suitable rubber-to-metal bond for an application.

Question: Why is adhesion to brass plate better than to brass?

Answered by Mr. Sawyer: We will get an argument from some quarters, but it has been our experience that the reproducibility of good bonds to 70:30 brass is better than to brass plate, providing the brass used has a low lead content. The brass plate process is subject to considerable variability in both the plating and bonding process. This results in inconsistent adhesion. With solid brass, the only precautions necessary are to make sure that the metal is clean and that the oxide film has been removed from the surface, preferably by polishing or blasting. Halogenated elastomeric primers should not be used as primers for brass or brass plate. Specially compounded cements should be applied directly to the metal.

Answered by Mr. Gage: A lot of argument can be stirred up by this question, since there is not 100 per cent agreement that brass plate will give better bonds than all types of brass. Brasses vary considerably in composition; some are difficult to bond, others are fairly easy to bond. Those which are essentially 70:30 in composition, which is the ratio most generally used in brass plating, are not usually difficult to bond. However, day

in and day out, a well-prepared brass plate surface is probably easier to bond to than a solid brass surface of the same composition.

Two possible reasons for this come to mind. First, the crystalline structure of a brass plate surface is less clearly defined than is that of a solid brass surface. Perhaps the amorphous characteristic of the brass plate makes it more reactive to the sulfur, thus permitting stronger sulfur bridges to be formed. Secondly, there are undoubtedly more impurities in solid brass than in brass plate, which may retard the formation of the sulfur bridge.

Answered by Mr. Larsen: Our experience is that it is not necessarily better. In theory we should be able to get just as good a bond with solid brass as with brass plate. Also, the one should be just as resistant to environmental degradation as the other. If the question is posed by someone who has had trouble with solid brass, it may be that the brass he has used was the free machining type and the lead content may have been too high for trouble free adhesion.

Answered by Mr. Irvin: Adhesion to brass plate is not necessarily better than adhesion to brass. In the case of brass plating, a rubber cover cement is immediately applied over the freshly plated surface, thereby eliminating oxidation of the brass. Also, the composition of brass that is used for plating is very closely controlled and is, of course, designed to be optimum for obtaining good adhesion. Brasses, on the other hand, may vary greatly in alloying constituents and the bond obtainable will vary accordingly.

Question: Discuss cover cements—all purpose, preparation and necessity—and cold versus hot application of adhesives.

Answered by Mr. Irvin: In some instances adhesives have to be applied hot, because of their thixotropic nature when cold. It is also sometimes the practice to apply cements hot to speed up dry times. In some cases the metal is warmed, sometimes the adhesive is sprayed hot; however, care must be taken to prevent premature curing of the adhesive or condensation of moisture on the adhesive surface.

The use of cover cements is rather widespread, particularly when difficult-to-bond stocks are encountered. There are certain rubber stocks which will probably always require the use of a cover cement to form a necessary bridging agent between the metal primer and the rubber stock that is to be bonded.

As far as preparation is concerned, no special precautions should be necessary, except that care must, of course, be taken that the cover cement during the application does not penetrate the prime coat. This is controlled to some extent by the adhesive manufacturer who usually employs less strong solvents in the cover cement than in the primer.

Answered by Mr. Gage: They can offer advantages providing the proper bonding agent is selected. Ordinarily, it is not necessary to treat the metal surface in a special manner to obtain good adhesion, but if for other reasons such treatments are specified, cements are available for high-quality bonding.

Question: What precautions are necessary to eliminate problems caused by humidity?

Answered by Mr. Gage: I assume the questioner is referring to those problems arising during periods of high relative humidity when there is a marked tendency for moisture to condense on the metal part during application and drying of the bonding agent. The problem involved here is to prevent the temperature of the metal from falling below the dew point. This may be done in several ways. One is to heat the metal prior to application of the cement. This is often done by applying the bonding agent directly after the metal has come from a hot degreaser. Or, the metal can be heated with a bank of infra-red lamps.

A second method is to use high boiling diluents. That is, select MIBK instead of MEK, xylene in place of toluene, and high boiling naphthas rather than hexane. In this way, the rate of evaporation is reduced and the degree of cooling of the metal surface is less. It is also possible to reduce moisture condensation by warming the cement to, say, 140° to 160° F., especially if high boiling solvents are used.

Question: Does the use of carbon black significantly affect rubber-to-metal adhesion? What type of carbon black is preferred for rubber-to-metal adhesion?

Answered by Mr. Sawyer: The answer to the first part of this question is definitely yes. An appreciably higher level of adhesion is obtained with carbon black than with any other type of filler. Channel black is preferred for rubber-to-metal adhesion. The thermal blacks which are used extensively in specification compounding also give good bonding properties. Blends of channel, thermal, and furnace blacks find extensive use in bonding stocks. Through accelerator and sulfur adjustments, equally good adhesion can be obtained in most instances.

Question: Discuss the technique of bonding rubber to steel wire rope.

Answered by Mr. Larsen: This would be a straightforward technique, making sure that the wire rope was clean and free from contaminants and that the adhesive application was intimate, that is, did not result in bridging or webbing so that portions of the wire would not be in contact with the adhesive.

Question: What is the effect of humidity on the bonding of rubber to metal?

Answered by Mr. Larsen: A high relative humidity can very often be a definite handicap to obtaining good permanent adhesion between rubber and metal. If moisture is condensed on the metal during the application of cement, or during the period between preparing the metal and the cement application, poor adhesion may result. What is more important, however, is that moisture encountered during these periods may well induce

corrosion between stock and metal, shortening appreciably the life of the bond. Good bonding practice dictates that care should be taken to prevent condensation of moisture by means discussed earlier in a previous question.

Question: Which is preferred, forced drying or normal drying of adhesives? What are recommended methods of forced drying?

Answered by Mr. Sawyer: If possible, it is best to dry film of bonding agents at normal temperatures, since most cements are designed to develop their maximum properties if the solvents evaporate as they normally would at room temperature. However, when drying times must be shortened, various ways of forced drying can be used. Banks of infra-red lights, a hot air tunnel drier, heating the metal prior to application of cement and heating the cement itself all are approved methods of forced drying.

Question: What is recommended practice for 100 per cent testing rubber to metal adhesion on parts without danger of destroying the bond? What type and amount of control testing on cements, compounds, and processing are recommended to insure perfect adhesion and eliminate the necessity of testing and destroying products?

Answered by Mr. Larsen: The answer to the first question is somewhat the same as the answer to the one concerned with the non-destructive tests predicting service life on rubber-to-brass adhesion. We can first, on a part such as the ones identified by the D-429 test, determine our bond value. We can then subject the part to a bond interface stress of something less than this total, and if no failure is noted we can stop the test at this point and pass the part on for shipping.

The answer to the second question ties in with it to the extent that we must be sure that the quality of adhesion that we are getting on the actual part is of the level reflected by the test samples on which we determined the bond value in the first place. The closer control that we have on our processing, the smaller the necessary percentage of our total production that we need to check either by the non-destructive test mentioned or by a destructive test. Such control features would include the constant checking of cement to make sure that it is up to standard. This can be done by testing as described in D-429. Then, going on the assumption that we have set up adequate tolerances for the process involved, we must make sure that our processing stays within the limits. Tolerances should be established for cement viscosity, cement application, visual inspection for tears and other uniformities. Then, storage conditions and layover time between cementing and vulcanizing should be established. Proper vulcanization techniques should be set up, such as minimum exposure to mold temperatures before rubber is applied to the bonding surface, correct temperatures, and avoidance of exposure to excess bond stresses while the part is still warm. Then in subsequent processing we should exclude those processes which would prove detrimental to the bond.

Question: How can consistent bonds be obtained with oil-extended styrene rubber compounds?

Answered by Mr. Sawyer: It has been our experience that the only precaution necessary, other than normal procedures, is to increase the acceleration and sulfur levels slightly. The thiazyl and thiazole acceleration should not be used alone but in combination with an ultra accelerator. In order to assure consistent bonds, a two coat adhesive system is recommended.

Question: How do tensile, modulus, elongation, tear and hardness properties influence adhesion?

Answered by Mr. Sawyer: This subject was covered quite fully in my opening remarks. To repeat, the high quality and high physical value stocks usually give the best bonding properties. Stocks in the medium hardness range, 50 to 60 Shore A durometer, generally bond best. The reinforcing fillers in the compound should be kept as high as possible, in line with the hardness specification. This reduces necking and tearing and as a result higher bond strengths are obtained.

Question: What particular resins can be added to elastomers to effect a thermosetting bond to metal when vulcanized in press or open steam autoclaves?

Answered by Mr. Sawyer: According to our interpretation of this question, you want to know if there are any resins that can be added to elastomers to effect a thermosetting bond to virgin metal surfaces during vulcanization. From our knowledge, there are no commercially available resins of this type. We might add that the commercial elastomer-to-metal bonding agents with which we are familiar do form thermosetting bonds upon the application of heat. Certain thermosetting resins, such as the phenol-formaldehyde type, are used as hardening and reinforcing ingredients in natural and synthetic rubber compounds. They do not generally improve the adhesive bonds obtained with commercially known adhesives and will not, so far as is known, effect adhesion by themselves.

Question: What effect does rate of cure of tie cement have on metal adhesion or over-all bond?

Answered by Mr. Sawyer: The rate of cure of the tie cement should be slightly delayed in order to permit the formation of sufficient chemical bridges between the tie cement and metal primer. If the tie cement cures too fast, poor adhesion between the cement and primer will result. If it cures too slow, there is always the danger of the body stock setting up before adhesion is developed. The answer to this question is to use a commercial cover cement which is designed to effect adhesion of stocks showing appreciably different rates of cure.

Question: Is there an adhesive that will bond neoprene to cast iron, both blast cleaned and machined?

Answered by Mr. Gage: Normally, neoprene is not a difficult polymer to bond. Also, cast iron is not a particularly difficult surface to bond. However, there are neoprene compounds that contain certain low temperature plasticizers that do resist bonding with the normally available commercial cements. When these cases are encountered, my advice would be to contact your supplier, submit to him your stock and metal, and let him give you a satisfactory solution.

Rubber Compounding Information

Sources Indexing Retrieving

By KATHLEEN S. ROSTLER
The Rubber Formulary, Bakersfield, Calif.

THERE was a time, some twenty years ago, when the subject of literature on the compounding of rubber was relatively simple. That was before the days when the compounding of rubber became complicated by having not just natural rubber to consider, but a large, continuously increasing number of different synthetic elastomers, each requiring compounding techniques and knowledge different from the others.

That the subject of the compounding of rubber was considerably less complicated twenty years ago can be seen from the fact that in 1935 under the joint auspices of the Research Association of British Rubber Manufacturers and the Rubber Growers' Association there was published a technical handbook entitled "Rubber Physical and Chemical Properties" in which the authors, T. R. Dawson and B. D. Porritt, were able to include in one volume the properties of all combinations of compounding ingredients which had been published up to that time. True, the task was even then a formidable undertaking.

Dawson and Porritt gave in tables of data taken from the original references the then-known information on the effects of each compounding ingredient on every property of rubber considered interesting. The book includes an "Index of Mixings," in which is listed in logical order every combination of rubber ingredients which had been published, with a reference to the appropriate table in the book. The number of compounds listed was 3226. In other words, when the only polymer which needed to be considered was natural rubber, there had been published up to that time only 3226 different compounds.

When we take into account the number of elastomers and the number of new types of products developed in the last twenty years, we begin to have some comprehension of the problem which confronts the chemist seeking to use the accumulated literature on rubber compounding. We have also to consider that the compounder of today, who should use this literature if he is to carry on his work effectively, is very often located in a small to medium-sized rubber factory, where he does not have available the services of a librarian or trained abstractor, but must find this source material for himself. This situation is also often aggravated by lack of time for extensive literature searching as well as lack of an extensive library.

If a literature search is to be made, there are in general four sources of information on the subject of compounding rubber. As for any scientific subject, the two first sources are books and journals. In the field of rubber compounding, however, a peculiar situation exists, in that the greatest part of available information on the subject is to be found not in books or in technical journals, but in the technical releases issued by the chemical manufacturers supplying the rubber fabricating industry. This is particularly true of the type of compounding information sought by the factory compounder. Another important, and usually the most frequently consulted, source of compounding information is the file of one's own compounds (in older times known as the "little black book").

The rubber compounder thus has four categories of recorded information at his disposal: books, journals, company releases and private records. The annotated bibliography which is appended to this paper is a list of books, periodicals and suppliers' releases which are considered the principal sources of compounding information. This list is by no means complete and has been restricted to publications giving practical information of interest to compounders.

Books

Basic books are the first logical source of information on any subject. In the bibliography accompanying this paper are listed those basic books on rubber which contain enough information on the subject of compounding to be considered a source of formulations. However, these books all share the one shortcoming that because new polymers and new compounding ingredients are continually appearing on the market, any book becomes out-of-date even before it is set in print.

These books are nevertheless useful to the young chemist who wants to gain some general information, and also to the experienced compounder starting to work in a field with which he is unfamiliar. They are important to the research worker who needs a condensed

Note: This article is based on a paper presented at the Symposium on Rubber Literature, jointly sponsored by the Division of Chemical Literature and Division of Rubber Chemistry, A. C. S., Atlantic City, N. J., September 18-19, 1956.

review of known information on a subject. For the usual compounding problem which arises for the factory compounder, however, basic books lose their usefulness very quickly after they are published.

In the section of the bibliography listing publications of suppliers to the industry there are cited a number of manuals and handbooks in which the difficulty of remaining current has been overcome by using a looseleaf form. These books are then kept up to date by adding new material or replacing portions which have become outdated by new developments. The companies supplying these manuals keep a list of the holders of the books to receive supplements as they are issued.

There are two books listed in the bibliography which, although they cannot be said in the strictest sense to contain compounding information, are invaluable in any library on the compounding of rubber. One is "Compounding Ingredients for Rubber," published by *Rubber World,* the other, "Rubber Red Book," published by RUBBER AGE.

Although information on compounding ingredients is more detailed in the former, "Rubber Red Book," revised every other year, is often more up-to-date. Compounders and purchasing agents do well to consult both books.

"International Rubber Directory" and "Rubber Trade Directory of Great Britain" fall into the same category.

Periodicals

The list of periodicals given in the bibliography is rather short, and only those published in the United States and in Great Britain are included. Although there are a number of other periodicals which contain articles on rubber, only those listed publish regularly information on compounding. It would add little to the practical usefulness of the appended bibliography to try to include every periodical which ever published a paper on compounding.

Also omitted from the listing are foreign journals (except British) although a number of them regularly present papers on rubber compounding. To a compounder in this country their usefulness is limited by the fact that so many of the ingredients, as well as the polymers, used in the formulations are not available here.

The journals of the American Chemical Society—*Industrial and Engineering Chemistry* and the Division of Rubber Chemistry's *Rubber Chemistry and Technology*—report studies on rubber compounding. Many of these studies are on materials which are still in the experimental stage. This is because American Chemical Society papers report new scientific work, which, in rubber compounding, frequently means development of new polymers or compounding ingredients.

These publications present important information for the compounder in order that he may keep abreast of developments in the field. However, until such time as the polymers and compounding ingredients become available commercially, this information provides little help with day-to-day problems. With these particular journals the situation is the reverse of that with basic books, in that back issues are more valuable than the latest to practical compounders.

Special Note . . .

As indicated by its title, the accompanying article discusses the basic sources of information on rubber compounds and methods of indexing and locating specific compounds. In a sense, it is also a comprehensive description of *The Rubber Formulary*, the monthly service which supplies data on individual compounds in punched card form. This service is available on an annual subscription basis and has proved invaluable to the companies and organizations which have been securing it. Our readers may be interested in learning that effective with January 1, 1958, RUBBER AGE has become the exclusive sales agent on a world-wide basis for *The Rubber Formulary*. Further details can be found on Pages 634 and 635 of this issue.—EDITOR.

Of the periodicals containing extensive compounding information the most useful ones for the factory compounder are probably RUBBER AGE, *Rubber World* and the *Transactions* and *Proceedings of the Institution of the Rubber Industry*. The first two, RUBBER AGE and *Rubber World,* not only publish compounding studies frequently, but most of them are both of timely and of practical interest.

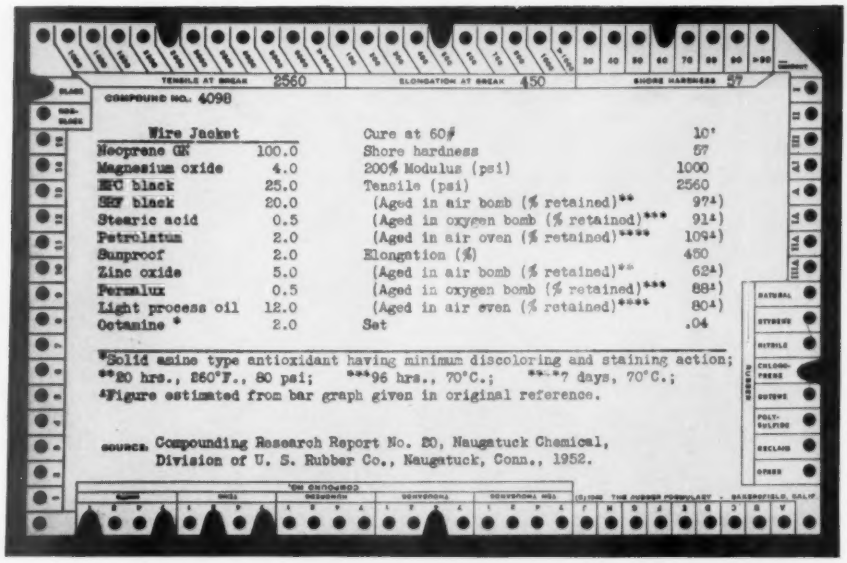
The I.R.I. *Transactions* and *Proceedings* are a particularly valuable source of compounding studies on natural rubber, a subject which takes second place in publications in this country. British compounders, not having economically available all the polymers open to compounders here, depend to a greater extent on varying the composition of natural rubber mixes to achieve a variety of properties. A case in point is the recent study of Moakes and Morrell on fire resistant rubber-vinyl blends for conveyor belts *(3)*. In this country this problem is minimized by the greater economic feasibility of using neoprene *(5)*.

Quite recently the French journal, *Revue Générale du Caoutchouc,* has started publication of English abstracts of its technical papers and a complete translation of the principle article. This journal has therefore been added to the list of periodicals valuable for compounds in this country *(8)*.

Releases of Suppliers to the Industry

The rubber industry is perhaps unique in the respect that technical information, rather than being available predominantly from journals or books, is, for the most part, free for the asking from suppliers to the industry, in whose laboratories much of the compounding research is carried out. This information provided in suppliers' releases is both basic, in that it pertains to systematic studies on variations of ingredients, and specific, in that it suggests recipes to meet given requirements.

The list of suppliers' releases given in the bibliography is not a comprehensive one. Almost every chemical supplier to the industry publishes valuable information


TENSILE AT BREAK 2560 ELONGATION AT BREAK 450 SHORE HARDNESS 57

COMPOUND NO. 4098

Wire Jacket			
Neoprene GK	100.0	Cure at 60#	10'
Magnesium oxide	4.0	Shore hardness	57
HMC black	25.0	200% Modulus (psi)	1000
SRF black	20.0	Tensile (psi)	2560
Stearic acid	0.5	(Aged in air bomb (% retained)**	97▲)
Petrolatum	2.0	(Aged in oxygen bomb (% retained)***	91▲)
Sunproof	2.0	(Aged in air oven (% retained)****	109▲)
Zinc oxide	5.0	Elongation (%)	450
Permalux	0.5	(Aged in air bomb (% retained)**	62▲)
Light process oil	12.0	(Aged in oxygen bomb (% retained)***	88▲)
Octamine *	2.0	(Aged in air oven (% retained)****	80▲)
		Set	.04

*Solid amine type antioxidant having minimum discoloring and staining action; **20 hrs., 250°F., 80 psi; ***96 hrs., 70°C.; ****7 days, 70°C.;
▲Figure estimated from bar graph given in original reference.

SOURCE: Compounding Research Report No. 20, Naugatuck Chemical, Division of U. S. Rubber Co., Naugatuck, Conn., 1952.

FIG. 1 — Example of a marginally punched card used for filing data on rubber compounds by *The Rubber Formulary*. Physical properties of the stock are indicated at the top, whether it is a black or non-black compound on the left, and type of rubber is seen on the right.

on compounding concerning the use of his ingredients in rubber mixes. Those releases listed in the bibliography have been selected as those which appear frequently and which offer a wide range of information.

Publications of suppliers are reviewed as they are released in the book review sections of both RUBBER AGE and *Rubber World*, so that any chemist interested in acquiring compounding literature may keep his library of suppliers' literature up to date by writing regularly for the latest releases. Many of the booklets are also mentioned in the "Industrial Literature" section of *Chemical and Engineering News* and the "Product Briefs" section of *Industrial and Engineering Chemistry*.

Advertisements in journals often contain the invitation to write for literature, an invitation usually worth accepting. A telephone call to the local sales agent of any supplier will also place an organization or individual on the mailing list of the company for technical releases on rubber compounding.

The fourth category of sources for compounding information, private records, needs no special discussion except for ways of keeping records so that the information recorded is both up to date and easily available. This aim is served by proper cataloging, abstracting and indexing the records, and is discussed at length later in this paper.

Abstracts and Indices

The most important aspect of the literature on any scientific subject is the availability of information. It is a truism that a specialist in any field cannot and need not know all the facts, but he must know where and how to find them. Rubber compounding is no exception. There are several means of finding information on the subject of rubber compounding. Before discussing the available abstracting and indexing services in detail, indices of individual publications should be mentioned. Not only do the journals in the field print annual indices, but those suppliers who publish extensively issue either annual subject indices or cumulative indices.

It is not possible to discuss indexing services on rubber compounding without again mentioning the work of Dawson and Porritt. Although it covers only the literature up to 1935, it provides a means of finding anything published up to that date.

Of current abstracting and indexing services, those in the English language which cover most extensively the field of rubber compounding are *Chemical Abstracts*, *Rubber Abstracts*, "Bibliography of Rubber Literature" and *The Rubber Formulary*.

Most articles on compounding published in technical journals as well as patents in the field are abstracted in *Chemical Abstracts*. However, since such a large proportion of the source material in this field (suppliers' releases) is not to be found in journals, it means that there is a large amount of information to be found in sources not listed in *Chemical Abstracts*.

Rubber Abstracts (until 1952 called *Summary of Current Literature*), now in its thirty-sixth year, is published monthly by the Research Association of British Rubber Manufacturers. It is the most outstanding publication in the field of reporting and summarizing the current literature on rubber. The coverage is very complete and includes journals from all over the world, patents, books and company releases. Abstracts range from a few lines to as much as half a column, and include literature references to other abstracts.

"Bibliography of Rubber Literature," edited by M. E. Lerner, was started by RUBBER AGE, and is now published by the Division of Rubber Chemistry of the American Chemical Society. It is essentially an index to the literature, and only one-sentence abstracts are given. Coverage is very complete, citing books, journals, patents (since 1940) and company releases. References to more comprehensive abstracts are given.

At the present time the volumes published cover only the period from 1935 through 1951. The committee working on this bibliography expects within the next few years to bring the abstracts up to date and also to publish cumulative ten-year volumes.

The Rubber Formulary

The Rubber Formulary differs considerably in nature from other abstracts. In the first place, it is published on marginally punched cards, and secondly, the abstracting is done on the basis of individual compounds, with each reported on a separate card. In each case are given the original reference, the formulation and all properties reported in the original reference. Perhaps this publication might more accurately be described as a catalogue of published rubber compounds. *The Rubber Formulary* covers all articles appearing in technical journals in United States and Great Britain which report formulations with test data, and also technical releases of suppliers containing this type of information.

This method of abstracting by individual compounds, which are coded by definitive properties and ingredients, has the advantage over conventional compounding literature that it makes it possible to find the kind of information which is difficult or impossible to locate through a subject index. Questions arise in compounding rubber like:

"Has an oil-resistant, white compound been made with a hardness of 40 Shore?"

"How can styrene rubber be compounded to meet a given specification and still stay in a reasonable price range?"

"What has been published on neoprene in the very low hardness range?"

"How can a nitrile rubber of a required minimum tensile be made without carbon black, and what happens to the other properties?"

The answers to these questions would be difficult to find in a subject index, since the compounds which answer the questions might have been published under any number of different topics. They can, however, be found in a file of individual compounds on marginally punched cards, which are coded according to ingredients and properties.

Punched Cards for Filing Rubber Compounds

Because the marginally punched card file is so admirably suited to filing rubber compounding information, not only that from the literature, but also that in individual laboratory records, it is worth while describing in some detail the system and its application to the subject.

The first person to suggest using punch cards for filing and retrieving rubber compounding information was J. D. Morron, who described in 1930 a system he had devised for use in his laboratory *(4)*. By means of coding compounds mixed in his laboratory on IBM punched cards he was able later to find all compounds having a given combination of physical properties.

The use of this machine-type card and equipment has the disadvantage of being expensive, which makes it difficult for any but a large organization to justify its use for a file the size usually employed with compounding information.

With the use of the marginally punched type of file cards, developed since that time, the application of a punched card file to rubber compounding information becomes feasible for any individual or organization, since the use of this type of file requires no investment in equipment. This type card also has the added advantage that all the information may be typed or written on the card, and read as easily as any other file card, the punches serving only as indexing devices for retrieving the proper card from the file. Although there is a limit to how many classifications may be used in the indexing, ample possibilities exist with careful planning for a file of many thousands of cards.

The marginally punched card lets one select cards from a file of rubber compounds on the basis of the physical properties of the mix, or of the ingredients in it, or of any other of a number of aspects, such as type of rubber goods, source of the information, cost of the compound, in fact, any basis on which a rubber compound might later be sought. For most purposes it suffices, however, to index the compounds by a few characteristic properties and ingredients.

The laboratories of the Research Association of British Rubber Manufacturers worked out a punched card system for filing compounds mixed and tested in their laboratories. The principal purpose of the system was to avoid mixing and testing the same compounds again. The compounds were indexed according to ingredients used in the mix and tests which had been performed on the compound. The system was described in a bulletin issued to the members of the association in 1948 *(6)*.

Operation of the Punched Card System

There is no need to discuss in general the marginally punched card system for filing technical information, as this has been done comprehensively in easily available publications, notably the book on the subject edited by R. S. Casey and J. W. Perry, which also includes a very extensive bibliography of other sources of information *(1)*. Suffice it to say that the principle on which the system operates is that the cards have holes punched around the edges, and a meaning, that is, an indexing classification, is assigned to each hole. Those holes are notched out on each card which pertain to the information on that particular card. Cards may then be retrieved from the file by running a steel needle through the hole for the classification desired. All those cards on which this hole is notched out, that is, those belonging to this classification, will fall out of the stack.

A file of marginally punched cards is simple and economical to operate. All the equipment needed is a ticket punch for notching out the holes and a sorting needle (similar to a knitting needle with a handle) for searching through the file. Once the cards have been selected from the file, they can be looked over and read like any file card.

These card files have, incidently, the advantage over the usual card file, where a misplaced card is as good as lost, that marginally punched cards need not be kept in any special order.

As an illustration of the way in which marginally punched cards may be used for filing and finding rubber compounding information, the card used for recording compounds in *The Rubber Formulary* is shown in Figure 1. Across the top of this card are groups of holes assigned to tensile strength at break, elongation at break and durometer hardness. The first hole on the left, labelled "1000" represents tensile strength up to 1000 psi; the second hole, labelled "1400," represents tensile

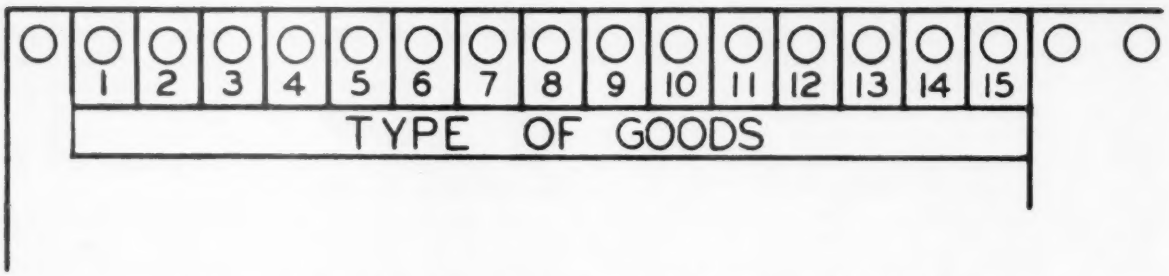


FIG. 2—A code for indexing by type of rubber goods. Possible categories might be the following:

1—Flooring	4—Insulated wire	7—Packings	10—Miscellaneous mechanical goods	13—Tires other than pneumatic
2—Footwear	5—Hose	8—Rolls	11—Tire accessories	14—Inner tubes
3—Heels and soles	6—Mountings	9—Tubing	12—Pneumatic tires	15—Miscellaneous

strength from 1000 to 1400 psi, and so on, up to tensile strength "over 6000." Elongation at break and Shore hardness are coded similarly.

Comparison of the properties of the compound on the face of this card with the notches across the top of the card shows how this coding is done. In the case of *The Rubber Formulary* cards, the figure for each of these properties is also written along the top. This is not necessary, but done merely for added convenience.

If it is desired to select the card shown in Figure 1 from a file, the procedure is as follows: Taking a conveniently-sized handful of cards from the file, the sorting needle is run through the hole labelled "2600" in the tensile field, and the needle shaken. All those cards notched in this hole, that is, all those having tensile strength betwen 2200 and 2600 psi, will drop out of the stack. This is repeated with successive handfuls of cards until all the compounds of this tensile range have been taken from the file.

With these cards the procedure is repeated putting the needle into the hole labelled "500" in the elongation field. The cards dropped from the needle in this sorting will all be compounds having tensile strength between 2200 and 2600 psi and elongation between 400 and 500 per cent.

The needle is inserted in the hole labelled "60" in the hardness field and the compounds with hardness between 50 and 60 are then retrieved from those of the desired tensile and elongation range. The resulting selection of compounds will consist of the one used for illustration, together with all the others in the file with the indexed properties in the same range.

On the left-hand edge of this card are two holes labelled "black" and "non-black," which makes it possible to code compounds as to whether or not they contain carbon black. On the lower right hand edge of the card is a classification by type of rubber in the mix, so that compounds may be selected on this basis.

Across the bottom of the card are holes utilized for indexing the cards according to the compound number. Each compound in *The Rubber Formulary* is assigned a consecutive number. Having this group of holes notched makes it possible to select a compound of a certain number from the file, or to put the file into numerical order to check for missing cards.

This code is interesting in that it illustrates a device commonly utilized on this type of card to economize on holes assigned to an index, by using only four holes for each digit of the number instead of nine. By labelling these holes "1," "2," "4," and "7," it is possible to notch any digit from 1 to 9. For 1, "1" is notched; for 2, "2" is notched; for 3, "2" and "1" are notched; for 4, "4" it notched; for 5, "4" and "1" are notched; and so on, up to notching "7" and "2" for 9. Although it is only necesary here to go as far as nine in any group of four holes, it is possible to use a group of four holes labelled in this way for up to fourteen classifications (14 is coded by notching all the holes).

This describes the mechanics of the file briefly; more detailed explanations of operating the file have been reported previously *(2,7)*. An issue of *The Rubber Formulary* consists of a pack of these cards, each containing one of the compounds published during that month, and each notched for those classifications to which the card belongs, so that they are ready to be put into the file and to be retrieved later on the basis of any of the classifications mentioned.

The classifications for selecting rubber compounds from a file, mentioned in discussing the sample card shown in Figure 1, are used in *The Rubber Formulary*

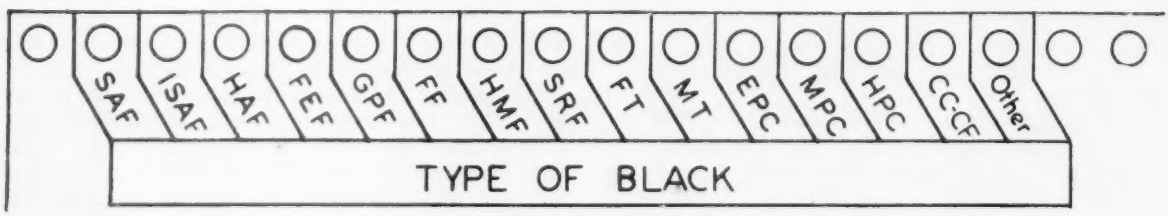


FIG. 3—A code for indexing by type of carbon black used in the stock.

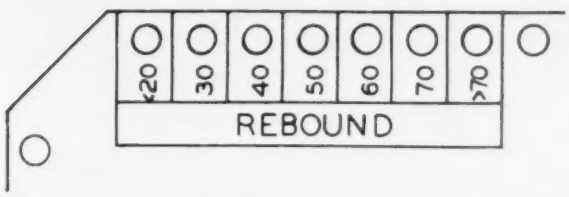


FIG. 4—A code for indexing by a physical property (rebound) in seven ranges, by per cent: less than 20, 20 through 30, 30 through 40, 40 through 50, 50 through 60, 60 through 70, and over 70.

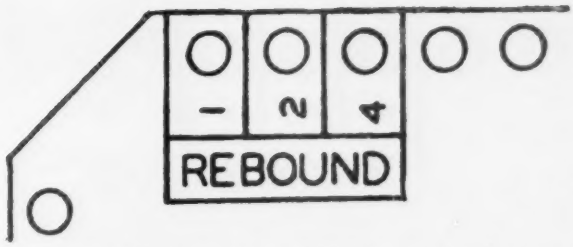


FIG. 5—Method of condensing a code for data on rebound so as to use only three holes.

1=less than 20%
2=20 through 30%
1 and 2=30 through 40%
4=40 through 50%
1 and 4=50 through 60%
2 and 4=60 through 70%
1, 2 and 4=over 70%

because they serve to define a rubber compound in general terms, because they are nearly always reported, because they are of interest to anyone who deals with rubber compounds and because they will ordinarily suffice to select from a file a small enough number of cards to be looked over by hand for final selection. It should be noted that the information on the card in Figure 1 is complete for the particular compound and not limited to the properties used for indexing.

There are, of course, many other classifications on the basis of which a compound might be coded in a punched card file for later selection. On the card in Figure 1 are a number of holes to which no meaning has been assigned, and which are left free to be utilized by the owner of the file for further classification if he so desires.

Figures 2 through 6 suggest a number of possibilities, other than those shown in Figure 1, for indexing rubber compound files on punched cards.

Figure 2 illustrates the possibility of classifying and retrieving rubber compounds according to the type of rubber goods for which they are intended. The suggested categories, keyed by number, are taken from the "Classified List of Rubber Products" section in the 1956 edition of "Rubber Red Book." The list is very broad. Some users of a compound file might have more specific interests, and would want to use more detailed categories covering less territory.

For some purposes it might be desirable to select from a file of rubber compounds those made with a specific ingredient. Figure 3 illustrates a possibility of setting up a code to select compounds on the basis of the type of carbon black in the mix. The same could be done with any other ingredient.

Figure 4 shows a classification by a physical property and illustrates how rebound might be coded on a card by the same method employed on the card in Figure 1 for tensile, elongation and hardness, using one hole for each of the seven ranges selected. It is possible to economize on coding space by condensing this code to three holes, using a numerical code similar to that explained in connection with the compound number punch. For this purpose each range is assigned a number, and the number is then notched in a number code. Figure 5 is an illustration of how the code for rebound shown in Figure 4 may thus be coded on the card with the use of only three holes.

This type of condensed code can be used only for properties. It cannot be used for ingredients because the compound can contain more than one of the ingredients in the list. The code for carbon blacks in Figure 3 could not, for instance, be condensed to a numerical code. If numbers 1, 2 and 3 were assigned to SAF, ISAF and HAF blacks, punching "1" and "2" would mean either that the compound contains HAF black (number 3), or both SAF black (number 1) and ISAF black (number 2).

Another possibility of coding for properties is illustrated in Figure 6. In this case each hole is assigned to a property and is notched if this property is reported. Such a code would be useful in searching for a compound to meet, for instance, a specification which includes requirements for compression set and for low

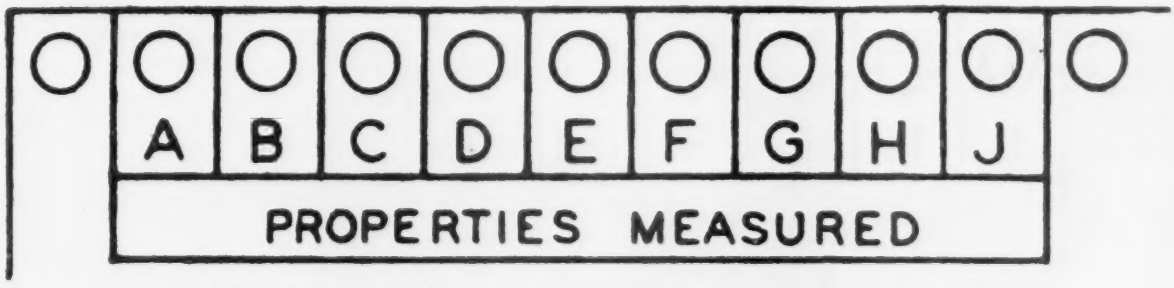


FIG. 6—Code for indexing according to properties measured. Possible categories might be:

A=Abrasion resistance
B=Low temperature effects
C=Compression set
D=Tear resistance
E=Electrical properties
F=Flex cracking
G=Heat aging
H=Water or steam resistance
J=Oil or fuel resistance

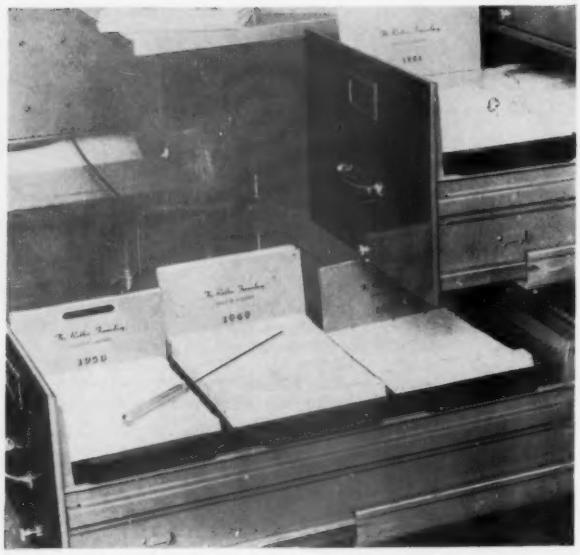


FIG. 7—One recommended method of storing cards, in cross trays of an ordinary filing cabinet.

temperature flexibility. It is possible with this index to select from the file the cards for only these compounds on which the compression set and low temperature flexibility had been measured and to look over these cards to find one meeting the specification.

These few examples illustrate how a punched card system can be adapted to the filing and retrieving of compounding information recorded as individual compounds and indexed by convenient and definitive properties. There are, of course, many other ways in which a file could be coded. However, in using a file of this type, it is surprising how few codes are actually needed, if they are carefully chosen. It is not necessary or desirable to make coding so detailed that only one or two compounds are selected from the file and all others eliminated. Since with this type of card all information is clearly written on the card, it is only necessary, as in any information search, to condense the references to a small number which can be looked through quickly to find the desired information. The time required to set up and maintain a code must be weighed against the time it will save in searching the file.

Storing Marginally Punched Cards

The matter of how to store a file might seem to be trivial. Actually, however, unless a file is kept in such a way that it is easy to get at it and to find the desired part of the file, the tendency is not to use it at all. Since the principal purpose of gathering information is not to store it on a shelf to collect dust, but to have it available when needed, it is important to give the matter some thought and then to organize the file in a simple but efficient manner. The time invested in setting up the file and instructing all prospective users how to operate it will pay handsome dividends in time and effort saved.

Marginally punched cards are made in standard file sizes, so that any equipment sold for file card storage may be used with them. (The size of the card used in *The Rubber Formulary* is 5 x 8 inches.) Figure 7 shows one convenient way of storing the cards, in cross trays in an ordinary file drawer. These cross trays are more convenient than card file drawers, because it is easier to get the cards out for sorting. Figure 8 shows one cross tray, containing one year of *The Rubber Formulary*. A slotter and sorting needle are also seen in the photograph.

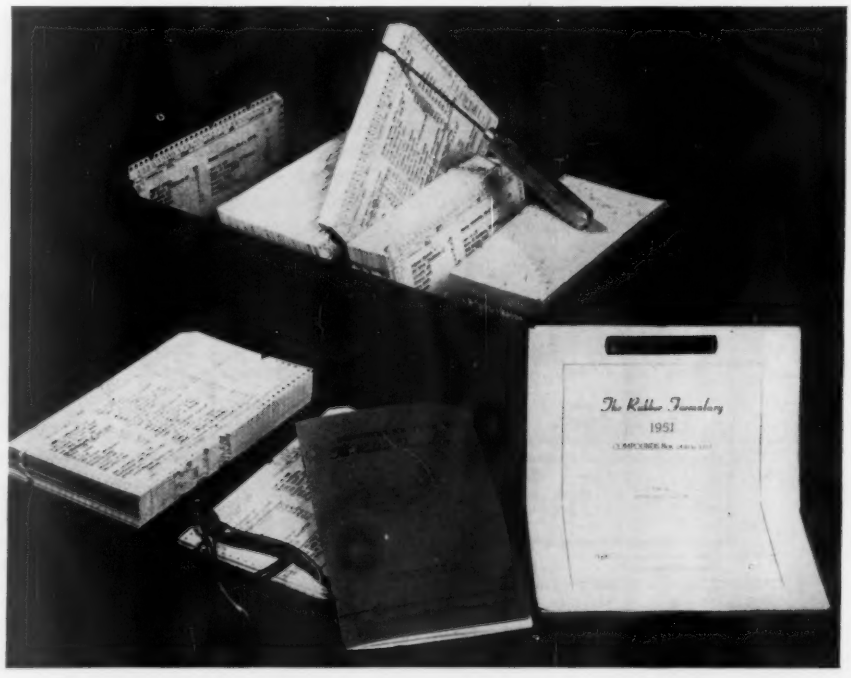


FIG. 8 — A cross tray containing the cards produced in one year, with a slotter punch for coding the cards and a sorting needle.

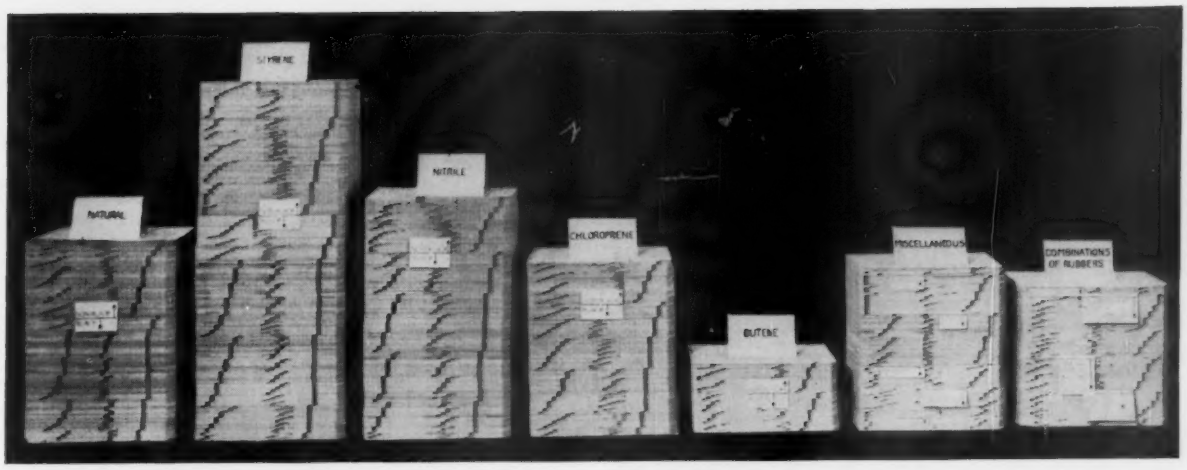


FIG. 9—Cards published by "The Rubber Formulary" during 1948 through 1955 sorted by coded characteristics. There are some seven thousand cards in the stacks.

Another important point to consider in maintaining a file is the order in which the cards are to be kept. After a file has grown to several thousands cards it becomes advisable to store the cards in groups. It saves a considerable amount of time if the cards are kept in such a manner that at least one needle sorting is saved in looking for information. The cards in Figures 7 and 8 are filed chronologically, that is, one year to each tray. This is the most convenient way of keeping the cards from the standpoint of ease of putting them into the file, because new cards are put in the last tray. Within each tray they can then be kept in order of hardness, or presorted by type of rubber. It is simple to keep marginally punched cards in order, because a glance at the edge of the file of cards shows when some are out of place.

Another way of keeping a file, which takes a little longer for putting cards into the file but saves time in taking them out, is to put all the compounds made with one elastomer in the same tray. Then, within the tray, they can be sorted by hardness, and so forth.

How the cards are kept, like how they are coded, depends on the purpose for which they are to be used. Each individual user of a file has to work out for himself the way which results in the greatest saving of time. The most important point to consider is that the cards should be arranged in a manner which makes using the file a quick and easy operation. When information is needed by a factory compounder, for instance, time is at a premium. With research workers and librarians the situation may be different. They should and usually do have the time to arrange and study technical information carefully, but even then the cards should be easily accessible and the file convenient to operate.

Sorting marginally punched cards in different ways is in itself an interesting little research project, providing valuable statistics and information. Figure 9 shows as an example the cards published by *The Rubber Formulary* during 1948 through 1955 (seven thousand cards) sorted by coded characteristics. Figure 10 is a closer view of the two right-hand stacks in Figure 9. The cards are stacked so that the forward edge shows tensile, elongation and hardness from left to right. The cards have been sorted first according to elastomer, and then divided as to whether they contain black, as indicated by the tags in the photograph. These groups have been sorted by increasing hardness, each hardness group by increasing tensile, and each tensile group by elongation.

A number of facts can be seen from the arrangement of cards in Figure 9. Most obvious is the height of the piles, showing how much compounding information was published on each elastomer. Looking at the arrangement of notches, it can be seen at a glance which combinations of properties occur most frequently. Among the black compounds for instance, most are in the 50 to 70 hardness range, where tire compounds fall. The sorting thus shows which property ranges are the most frequently investigated.

In the foreword of the often quoted book by Dawson and Porritt it is stated that one purpose of their compilation was to point up where gaps exist and thus to suggest areas for compounding studies. The arrangement of cards in Figure 9 shows these areas very clearly for the latest literature. It might be worthwhile for suppliers of polymers and compounding ingredients to note these gaps, to make compounding studies to fill them and to publish the results. Since rubber is a material of construction with great versatility of properties and is used for a variety of applications, it would enhance the technological value of rubber to fill these voids.

Punched Cards for Filing Internal Records

In the field of rubber compounding the problem of finding information is by no means confined to finding references in the literature. Much effort is duplicated in laboratories through difficulty in finding data on previously mixed and tested compounds, which might very well solve a current problem. The larger the organization and the longer the laboratory has been operating, the more inefficient it becomes to depend on the memory of chemists as to whether compounds of any given composition or properties have been mixed before.

A marginally punched card file provides an effective means of eliminating this difficulty. If all compounds are recorded and put into an efficiently coded and well maintained punch card file as fast as they are mixed and

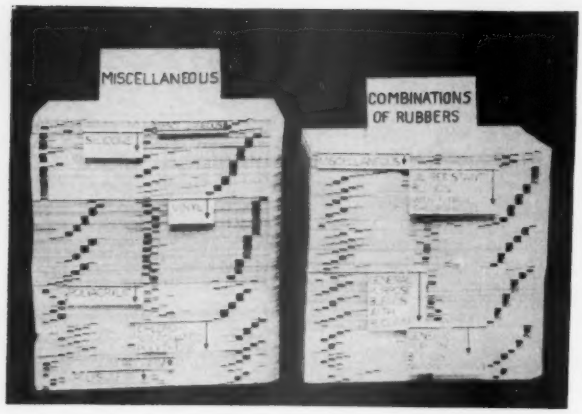


FIG. 10—Close-up view of the two righthand stacks in Figure 9, containing the cards with data on miscellaneous polymers and combination of rubbers.

tested, it will eventually place all experience of the organization, previous and current, at the fingertips of any member of the personnel.

Many laboratories are currently using this method of keeping internal records. In fact, *The Rubber Formulary* as a literature abstracting service grew out of a file of cards of the same type for internal compounding records used some years ago at the Engineering Experiment Station of the University of Delaware. A number of laboratories are using the same type cards at present (*The Rubber Formulary* supplies blank cards for this purpose).

The use of these files once set up should not, however, be confined to the laboratory chemist. Salesmen offering ingredients to rubber manufacturers are often required to solve compounding problems for their customers. Technical representatives having such a file at hand can operate much more efficiently than those who have to write to their home office for bits of information.

As mentioned earlier in this paper, Dawson and Porritt condensed in one volume, and in one index in that volume, all the rubber mixtures which had been reported in the literature up to 1935. Every few years since that time there has appeared in the rubber literature an article or an editorial bemoaning the fact that no similar work has been compiled since *(9)*. The use of a properly coded punched card file as an intermediate step would bring this task into the realm of possibility. Compounds from a good part of the literature since 1948 are already on the cards of *The Rubber Formulary*. Those from the other years and from the European journals could be added and the file properly coded. From that point on, the task would consist of working with a sorting needle.

Summary

This paper has attempted to point out the variety of sources available to those seeking information on the compounding of rubber, and to suggest means for making this information accessible. Existing abstracting services have been cited. A file of marginally punched cards for rubber compounds has been described and suggested as a way of filing and retrieving this type of technical information from private records as well as from the literature.

The annotated bibliography appended lists the sources of compounding information available in the form of books, periodicals, company releases and abstracts, which are considered by the author to be the richest sources for actual formulations. Particular emphasis has been laid on the type of information sought by the compounder working on practical factory problems.

LITERATURE REFERENCES

(1) Casey, R. S., and Perry, J. W., "Punched Cards, Their Application to Science and Industry," New York: Reinhold Publishing Corp. (1951).

(2) "Instructions for Use of The Rubber Formulary," Bakersfield, Calif.: The Rubber Formulary (1949). (Booklet issued to subscribers).

(3) Moakes, R. C., and Morrell, S. H., *Proc. Inst. Rubber Ind.*, Vol. 2, p. 179 (1955); "The Rubber Formulary," Compound Nos. 7008-7037 (February, 1956).

(4) Morron, J. D., *I. R. W.*, Vol. 82, p. 61 (1930).

(5) *Neoprene Notebook*, No. 68, p. 464 (1956)

(6) Research Association of British Rubber Manufacturers, "Punched Card Indexing for Mixing Data," Bulletin I.D. 5111 (April 2, 1948).

(7) Rostler, K. S., *I. R. W.*, Vol. 120, p. 698 (1949).

(8) *Rubber Chem. Tech.*, Vol. 29, No. 1, p. XI (1956).

(9) *Rubber J.*, Vol. 128, No. 13, p. 8 (1955).

Annotated Bibliography of Sources of Information on Elastomer Compounding

Books

H. Barron, "Modern Synthetic Rubbers." New York, D. van Nostrand, 2nd Edition, 1943.

Information on general principles of compounding and formulations for specific purposes in accordance with compounding practices and available polymers at the time of publication.

"Compounding Ingredients for Rubber." New York, Bill Brothers Publishing Corp., 2nd Edition, 1947.

Systematic list, by groups, compiled by the editors of **India Rubber World** (now **Rubber World**) of all raw materials used in compounding, giving properties, function and suppliers.

H. B. Cronshaw, "The Rubber Industry." London, Leonard Hill, 1936.

An encyclopedia of the British rubber industry, with general information on practices, including compounding, in dictionary form, and an alphabetical list of compounding ingredients by chemical and trade name.

C. C. Davis and J. T. Blake (Editors), "The Chemistry and Technology of Rubber." New York, Reinhold, 1937. (A.C.S. Monograph No. 74).

Published under auspices of Division of Rubber Chemistry, American Chemical Society, each chapter contributed by an authority in the field. Includes several chapters discussing effects of type and proportion of compounding ingredients and a chapter on practical compounding of natural rubber with examples of typical formulations.

T. R. Dawson and B. D. Porritt, "Rubber—Physical and Chemical Properties." Croydon, England, Research Association of British Rubber Manufacturers, 1935.

A comprehensive treatise including results of all research on rubber up to March, 1934; the greatest portion devoted to results of compounding variations. Includes bibliography of 1400 items, glossary of terms used in rubber technology, descriptions of test methods, various conversion tables and a compound index giving every published compound up to that date with reference to places where it appears in the tables of the book.

Institution of the Rubber Industry, "Proceedings of the Rubber Technology Conference," 1938, edited by T. R. Dawson and J. R. Scott; "Proceedings of the Second Rubber Technology Conference," 1948, edited by T. R. Dawson, C. M. Blow and J. R. Scott; and "Proceedings of the Third Rubber Technology Conference," 1954, edited by T. H. Messenger. All published in Cambridge, England by W. Heffer and Sons.

Papers given at the international conferences held under the auspices of the Institution of the Rubber Industry, many of which deal with the subject of compounding.

"International Rubber Directory." Zurich, Verlag für Internationale Wirtschaftsliteratur, 2nd Edition, 1955.

In German, French and English. Includes a brief list of chemicals and raw materials with suppliers in the principal countries.

R. C. W. Moakes and W. C. Wake (Editors), "Rubber Technology." London, Butterworths; New York, Academic Press, 1951.

Lectures given at summer school of the Research Association of British Rubber Manufacturers. One, by R. C. W. Moakes, concerns recent developments in compounding.

"Rubber Red Book." (Directory of the Rubber Industry 1957-58). New York, Palmerton Publishing Co. 11th Issue, 1957.

Compiled by the editors of **Rubber Age.** Includes classified listings of elastomers and latices, and compounding ingredients, and their trade names and suppliers.

"Rubber Trade Directory of Great Britain." London, Maclaren and Sons, 2nd Edition, 1952.

Includes lists of suppliers in Great Britain of rubber chemicals and natural and synthetic elastomers.

"The Services Rubber Investigations—Users' Memoranda with Revisions and Addenda." Issued by the British Ministry of Supply, London, H.M.S.O., 1954.

Compilation of memoranda published separately during the war years by the Services Rubber Investigations Panel, based chiefly on research carried out for the armed forces at laboratories of Imperial Chemical Industries. Information consists chiefly of consideration of physical properties of elastomers, test methods for them, and relative rating of performance of synthetic polymers. Includes recommendations for compounding individual polymers to improve specific properties.

H. J. Stern, "Practical Latex Work." Leicester, England, Blackfriars Press, 3rd Edition, 1955.

Short practical manual on natural and synthetic rubber latices. Compounding suggestions and typical formulations given for each type of goods.

H. J. Stern, "Rubber: Natural and Synthetic." London, Maclaren and Sons, 1954.

Chapter on compounding ingredients discusses types of each ingredient in use. In chapters on synthetic rubber and on manufacturing processes, are cited typical production formulations for specific goods.

G. S. Whitby, C. C. Davis and R. F. Dunbrook (Editors), "Synthetic Rubber." New York, Wiley; London, Chapman and Hall, 1954.

Published under auspices of Division of Rubber Chemistry, American Chemical Society, each chapter being contributed by an authority in the field. Includes a considerable amount of information on compounding synthetic elastomers, illustrating general characteristics of compounds by tables with test data, and giving typical recipes for rubber goods.

Periodicals

"Annual Report on the Progress of Rubber Technology," Cambridge, England, published annually by the Institution of the Rubber Industry.

Review articles on all phases of rubber technology. Considerable information on compounding. Particularly valuable for its extensive bibliography of articles, patents and company releases.

"Industrial and Engineering Chemistry," Washington, D. C., published monthly by the American Chemical Society.

Publishes most papers from Division of Rubber Chemistry reporting new developments in compounding elastomers, many being studies of new polymers and compounding ingredients still in experimental stage.

"Revue Générale du Caoutchouc," Paris, published monthly.

Reports a great number of articles of theoretical and practical interest. Includes abstracts of journal and patent literature. Started recently to include English translations of some articles.

"Rubber Age," New York, published monthly.

Papers on compounding published almost every month; usually timely and of practical interest. Book review section covers new books and company releases.

"Rubber and Plastics Age," London, published monthly.

Several articles on compounding published during each year.

"Rubber Chemistry and Technology," Lancaster, Penna., published quarterly under auspices of Division of Rubber Chemistry, A.C.S.

Consists of reprints from other journals and translations from foreign language journals. Some papers on compounding.

"Rubber Journal," London, published weekly.

Several articles on compounding published during each year, usually in serialized form. "Views and Reviews" column in each issue discusses papers in other journals and new releases from suppliers.

"Rubber World," New York, published monthly.

Papers on compounding published almost every month; usually timely and of practical interest. Book review section covers new books and company releases.

"Transactions of the Institution of the Rubber Industry," and "Proceedings of the Institution of the Rubber Industry," London, published bi-monthly bound together.

Papers on compounding of rubber, usually natural rubber, published in almost every issue.

Publications of Suppliers and of U. S. Government Agencies

(This list, including books, series, looseleaf services and news releases, is not exhaustive but is limited to those published regularly or frequently and having a wide variety of information.)

American Cyanamid Co., Intermediate and Rubber Chemicals Department, Bound Brook, N. J.

"Rubber Chemicals Technical Bulletins." Each bulletin covers one product, giving description, properties and a number of formulations with physical properties illustrating its use.

Barrett Division, Allied Chemical and Dye Corp., New York, N. Y.

"Rubber Laboratory Releases."Usually basic compounding studies reporting very extensive physical data on a few formulations.

Godfrey L. Cabot, Inc., Boston, Mass.

"Technical Service Laboratory Bulletins." Informal reports of laboratory studies on effects of compounding variations in compounds of all types with the company's carbon blacks.

"Cabot Technical Reports." More formal reports of laboratory studies on effects of compounding variations. Recent releases have concerned tire formulations with road test results.

Columbian Carbon Co., New York, N. Y.

"Columbian Colloidal Carbons." Series of booklets. Fundamental information on carbon blacks and their use in rubber. Recent issues have been reprints of journal articles.

"Columbian Carbons in Natural and Synthetic Rubbers." Looseleaf. Consists of reports in tables and graphs of the effects of increased loadings of various carbon blacks in several elastomers.

"Red Oxide of Iron." 1941. Includes a section on general principles of use of iron oxide in compounding with recipes for specific goods.

Columbia-Southern Chemical Corp., Pittsburgh, Penna.

"Calcene Bulletins; Silene Bulletins; Hi-Sil Bulletins." Results of compounding studies with the company's white fillers, usually illustrated by practical factory formulations.

E. I. du Pont de Nemours and Co., Elastomer Chemicals Dept., Wilmington, Del.

"Formal Reports." Each deals in detail with the basic principles of compounding with one of the company's elastomers or compounding ingredients. Several are issued each year.

"Informal Reports" (BL Reports). Brief reports, with formulations and test data, each dealing with a specific and timely practical compounding problem. Usually issued at the rate of one or more each month.

"Mechanical Molded Goods: Neoprene and Hypalon." By D. C. Thompson, 1955. About half of the book is devoted to processing, half to compounding, of mechanical molded goods with the two types of elastomers. The compounding section includes basic information on compounding to obtain desired properties and a long table, arranged by hardness and tensile strength, of recommended fromulations for mechanical goods.

"The Neoprenes: Principles of Compounding and Processing." By N. L. Catton, 1953. Comprehensive descriptions of all types of neoprenes with discussions, illustrated by extensive tables and graphs of vulcanizate properties, and of effects of compounding variables. Numerous bibliographical references to journal articles and company reports.

Enjay Co., Inc., New York, N. Y.

"Butyl Bulletins." A relatively new series of bulletins designed to present results of new research on butyl elastomers.

"Enjay Butyl." Looseleaf. Recommendations for processing and compounding this elastomer with discussions, illustrated by data on a series of compounds, of the effect of compounding variations on various physical properties.

"Enjay Butyl for Tires." Looseleaf. A comprehensive presentation of data on tire compounding with butyl rubber.

Golden Bear Oil Co., Oildale, Calif.

"G. B. Reports." Original reports and reprints of articles giving basic compounding information, particularly pertaining to the use of petroleum-derived compounding ingredients.

B. F. Goodrich Chemical Co., Cleveland, Ohio.

"Service Bulletins." Each deals in detail with one or one group of the company's polymers or compounding ingredients. Included are both basic compounding information, illustrated by data on a test series, and recommendations for factory compounds.

"Hycar Technical Manual." 1951. Complete compounding and processing information on the Hycar acrylonitrile copolymers, including both general recommendations, illustrated by extensive tables of data, and specific recommendations for formulations for different types of goods to meet a number of specifications.

"Hycar Technical Newsletter." Formerly published monthly, now irregularly. Gives information on new products, new compounding techniques, and suggestions for factory compounds. Combined at the end of the year into an annual edition, which also contains information not included in the monthly issues.

Goodyear Tire and Rubber Co., Chemical Division, Akron, Ohio.

"Techni-Guides." Extensive reports dealing with the company's elastomers and resins, including both basic compounding and processing information and recommendations for factory compounds.

"Tech-Book Facts." A new series of brief releases giving both basic information about elastomers and resins, and factory compound suggestions with test data.

J. M. Huber Corp., New York, N. Y.

"Huber Rubber Products Manual." Looseleaf. Descriptions of the company's carbon blacks, clays and other compounding ingredients and their use in various elastomers and types of compounds, illustrated by basic test series and practical formulations with test data.

"Kaolin Clays and Their Industrial Uses." 1949. A large proportion of this book is devoted to discussion, illustrated with tables of compound data, of effects of type and amounts of clay, and of effects of variations of other ingredients in clay compounds of natural and synthetic rubbers.

Imperial Chemical Industries, Ltd., Dyestuffs Division, Birmingham, England.

"The Fundamentals of Rubber Technology." 1947. Compilation of eight lectures given to students at Newton Heath Technical School by members of the staff of Imperial Chemical Industries; comprises a brief elementary text on the subject. One lecture is devoted to basic compounding principles.

"The GR-S Manual." 1947. Basic manual on processing and compounding styrene rubber, including comparison of polymers available, effect of compounding variations and specific formulas.

Indoil Chemical Co., Chicago, Ill.

"Circulars." Brief reports, each showing a test series with data illustrating the use of the company's petroleum plasticizers in one specific type compound.

Naugatuck Chemical Division, U. S. Rubber Co., Naugatuck, Conn.

"Compounding Research Reports." Each deals either with one group of the company's compounding ingredients or with one type of rubber compound. Information in the series includes both basic compounding information illustrated by test series and suggestions for factory formulations.

"Technical Bulletins." Information on compounding the company's Paracril elastomers. Each bulletin deals with either one phase of compounding or one class of practical formulations.

"Naugatuck Rubber Chemicals and Paracril." By F. L. Holbrook. 1954. First half of this book consists of descriptions of compounding ingredients and elastomers offered by Naugatuck Chemical, with brief recommendations for their use. The second half consists of recommended formulations with test data for a variety of different types of rubber goods.

Phillips Chemical Co., Akron, Ohio.

"Rubber Chemicals Bulletins" (formerly called "Philblack Bulletins"). Reports of basic compounding studies on the company's carbon blacks, polymers and plasticizers, with extensive test data. "Bulletin P-1, etc." This series originally consisted of booklets giving complete information on compounding with each of the company's carbon blacks; recent bulletins have been reprints of papers.

"Rubber Grade Carbon Blacks." A one-page chart listing, under each type of black, trade name and suppliers of all brands made in this country. Revised periodically.

"Philprene Polymers." Looseleaf. Catalogue of company polymers with specifications, compounding recommendations and formulations with test data for specific rubber goods.

Thiokol Chemical Corp., Trenton, N. J.

"Thiokol Synthetic Rubber and Chemicals." Looseleaf. Description of the company's polysulfide polymers and recommendations, both general and specific, for their compounding and processing. (No additions or revisions have been issued for a number of years, so that more recently developed polymers are not included).

"Thiokol Bulletins." (Butyl Technical Service). Basic studies of butyl rubber with extensive test data.

"Thiokol Technical Service Bulletins." Technical information and compounding studies on the company's rubber chemicals.

United Carbon Co., Charleston, W. Va.

"Development and Status of Carbon Black," by I. Drogin, 1945; "Today's Furnace Blacks," by I. Drogin and H. R. Bishop, 1948; "Extrusion Factors of Black Rubber Compounds," by I. Drogin, H. R. Bishop and D. Wiseman, 1954 (reprinted from **Rubber Age**, February, 1954); "The Role of Intermediate Level Carbon Blacks in Rubber," by I. Drogin, 1954 (Reprinted from "Proceedings of the Third Rubber Technology Conference"). Comparative studies of different types and brands of carbon blacks at different loadings in natural and synthetic rubbers. Very extensive test data reported.

U. S. Bureau of Ships, Washington, D. C.

"U. S. Navy Rubber Formulary." Looseleaf. Suggestions for formulations to meet military specifications with test results obtained.

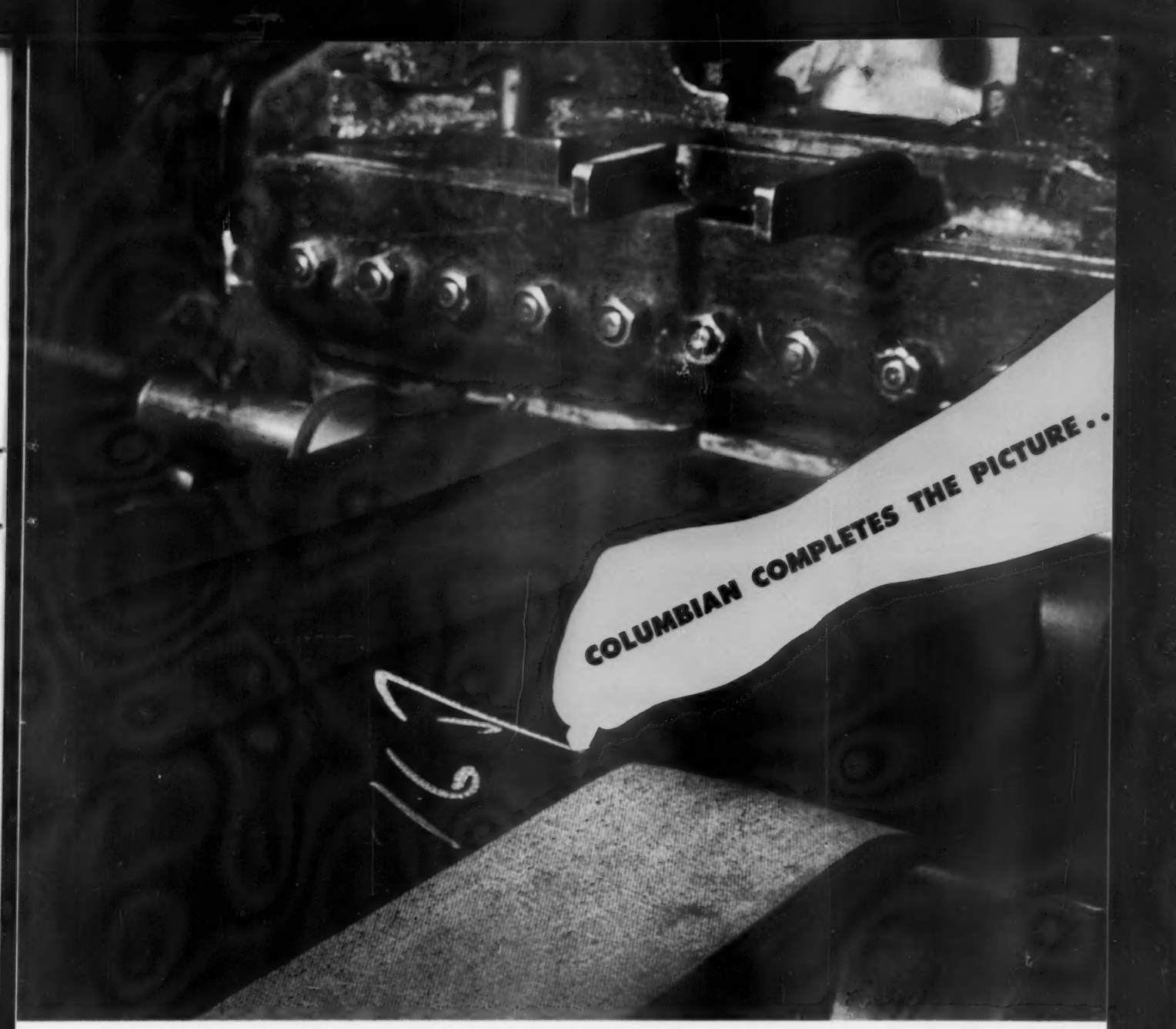
U. S. Reconstruction Finance Corp., Office of Synthetic Rubber, Washington, D. C.

"Sales Catalogue, GR-S and GR-I Type Synthetic Rubbers." Looseleaf. Descriptions with test results in standard formulas of all government polymers. (This publication will continue to be of practical interest as long as suppliers continue to use government designation numbers to describe polymers.)

R. T. Vanderbilt Co., New York, N. Y.

"The Vanderbilt News" published quarterly. Each issue consists of several articles on various phases of compounding, illustrating the use of the company's wide range of compounding ingredients, giving formulations and test data.

(Continued on page 728)



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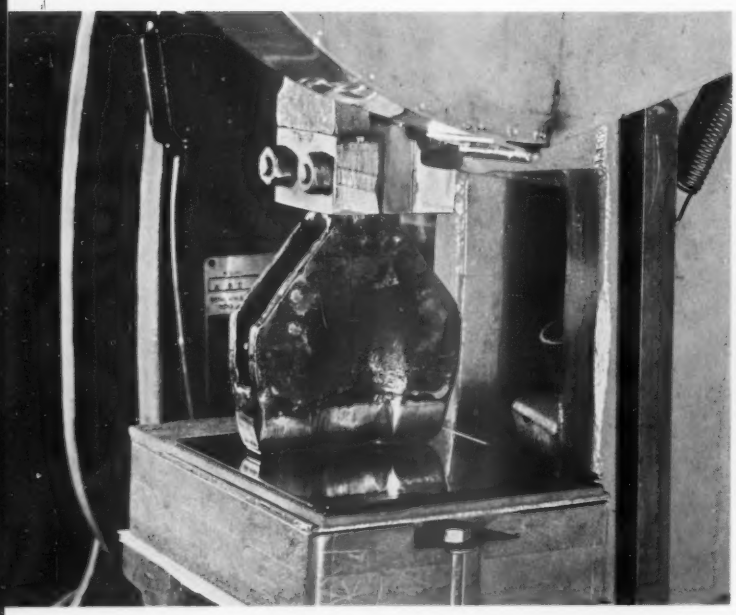

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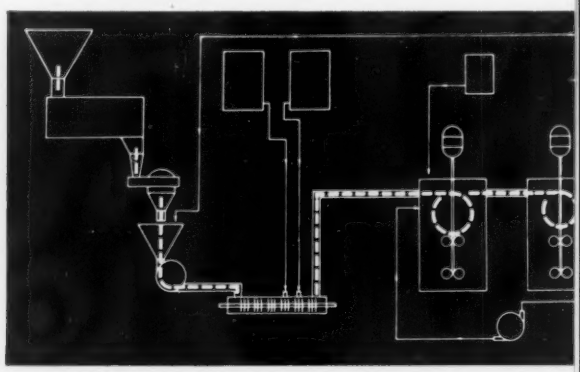

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MICRONEX W-6 EPC Easy Processing Channel
STATEX-B FF Fine Furnace
STATEX-M FEF Fast Extruding Furnace
STATEX-93 HMF High Modulus Furnace
STATEX-G GPF General Purpose Furnace
FURNEX® SRF Semi-Reinforcing Furnace

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Editorials..

Story of Two Sons

► The story is told of the parents who were concerned about the striking differences in the behavior patterns of their young twin sons. One was given to exhuberance, finding pleasure in many things. The other son found little to be joyful about. The parents finally decided to take their children to a psychiatrist in an attempt to discover the reasons for their sons' attitudes. The psychiatrist decided to test the youngsters and for this purpose placed the doleful son in a room full of the choicest toys. The other he placed in a dour, dank cell, filled with nothing but straw. Through a specially constructed window which permitted him to observe the boys without himself being seen, he spent many watchful hours observing his two small patients.

The dour son sat amidst the splendor of the many toys and baubles and remained dour. The exhuberant son, on the other hand, frolicked busily through the straw, burrowing beneath the piles, finding pleasure in the texture and the smells. The behavior of the second son puzzled the psychiatrist more than the attitude of the first. Why, he wondered, was the second son so happy in such unhappy surroundings? He decided to question the youngster. "Son," he said, "how is it that you seem to find so much happiness in a dark cell furnished with nothing but straw when your brother in fine surroundings and with many toys is unhappy?" "Doctor," answered the boy, "the way I figure it—with all the straw in that cell, there has got to be a pony in there somewhere!"

And so it is with many of our friends in the rubber industry. Many of us, surrounded by the pleasant sight of an aggressive, expanding and profitable industry, find little pleasure in what we see. This becomes all the more apparent at this time of year when a spate of year-end statements and prognostications make their appearance. Many of us seem to want to discover only a dark picture, plucking at little straws of discontent.

Any year-end appraisal, or any judgment for that matter, must take into account the good as well as the bad. Only in this way can a reasonable assumption as to the course of future events be made. It is apparent to us that too many this year have chosen to take a pessimistic view of what lies ahead for the rubber industry and for the general economy in total. Any year which does not break a record is considered to be a poor year indeed. This hardly seems to be the proper attitude.

Our own reasoned appraisal of the rubber industry for 1958, which appears elsewhere in this issue, takes all these factors into account. There would be little point in rehashing all the matters we discuss in our annual "Review and Preview" in these columns. Suffice to say that while we feel that 1958 may not be another 1955 for the rubber industry, it may well be a year of progress and profit.

Where the general economy is concerned, it is estimated that about 6.1 million passenger automobiles were produced in the United States in 1957. The sages advise that 1958 may only hit a 6 million figure. Immediately, this figure is leaped upon by some as pointing to recession and dark days ahead. Let's be reasonable. Are 6 million cars negligible? Will not 6 million cars mean a reasonable number of original equipment tires? Will not 6 million cars two years hence provide for a reasonable number of replacement tires? Why the gloom?

Take the matter of capital expenditures. "Aha," says the dour son, "rubber industry capital expenditures are going to fall by 7 per cent in 1958—only $193 million!" Only $193 million indeed! Has the "dour son" considered that the sum planned for capital expenditures in 1958 is almost exclusively meant for modernization and expansion of finished product capacity? The $208 million spent in 1957 took into account new copolymer facilities. In this light, is not the figure for 1958 remarkable?

"Look," declares the dour son, "see how business failures have been on the increase! Business failures in the United States in 1957 were up 8 per cent over 1956! Th rubber industry is in for some dark days!" Well, what is the answer? As we have previously stated in these columns, in the eighteen year period ending in 1957 the rubber industry suffered *only 50 business embarrassments*. In the last two years alone, over two hundred new rubber companies have entered the field!

A recent survey of some 1,600 business executives in the United States by a leading financial journal revealed that most businessmen expected high business activity for their own companies during 1958 but were less optimistic about the nation's economy as a whole. This appears to be rather an odd attitude. Certainly, if most individual enterprises will do well in 1958, then the national economy will do well. Is not the national economy the sum total of financial activity at all levels? Why the "dour son" outlook?

We are firmly of the opinion that 1958 will be a good year for the economy as a whole and for the rubber industry. We base our opinion upon a sober appraisal of the facts available to us and our estimates of what may be expected in the months that lie ahead. We deplore the "dour son" attitude and we stress that an industry that reckons its sales at close to $6.5 billion a year is a healthy industry.

It is said that the pessimist views the partially filled container as being half-empty while the optimist sees it as being half-full. Our cup may not runneth over—but we believe that it is more than half-full and we look forward to 1958 and the years that follow with confidence.

Linear Polyethlene

Issuance of New Patent to DuPont Poses New Problems For Polyethylene Industry

► E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has announced that the company has been granted a United States patent on linear polyethylene, a type of plastic that several other companies are either producing or building plants to manufacture. The patent, No. 2,816,883, covers linear polyethylene "as a composition of matter", regardless of how it is made, according to Robert L. Hershey, general manager of the company's Polychemicals Department. DuPont states that it is the only company entitled to license the manufacture of the plastic. The company has notified other producers that the patent award is forthcoming and has offered manufacturing licenses.

Concerns currently making linear polyethylene are the Celanese Corp. of America, Phillips Chemical Co. and the Hercules Powder Co. Others, whose plants are either in construction or are approaching production, include W. R. Grace & Co., Union Carbide Corp., Koppers Co. and the Dow Chemical Co. Union Carbide has licenses from both Phillips Petroleum Co., parent company of Phillips Chemical and from Karl Ziegler, who developed a German process that is also licensed to Koppers, Hercules, Dow and DuPont. A process developed by the Standard Oil Co. (Ind.) has been licensed to the Eastman Kodak Co. and the Spencer Chemical Co.

Phillips Voices Opinion

Phillips contends that the patent issued to DuPont does not affect Phillips' applications for patents on its own process for making linear polyethylene plastic. Phillips disputes DuPont's claim that the U. S. patent covers the plastic "no matter how it is manufactured" and its proposal to issue manufacturing licenses to present and potential producers and collect royalties even though these manufacturers should now be licensed by Phillips and others.

A spokesman for the company states "The DuPont patent is based on the old high-pressure process, which is entirely different from the Phillips process. The DuPont patent has polyethylene product claims which contain a number of limitations. As it is doubtful that these claims cover Phillips polyethylene or that they are valid or sustainable, it is believed that Phillips and its licensees will not be adversely affected." If DuPont's patent should be determined to be valid and infringed, he continued, the effect on the production cost of Phillips polyethylene would be "minor and its selling price would not be increased".

Authorities in the plastics industry predict that a long period of negotiation, study and possible court litigation may precede any settlement of the claims.

W. R. Grace Comments

W. R. Grace & Co., which began producing linear polyethylene recently under a Phillips license said that any patent problem involved would be Phillips' responsibility, in accordance with the license agreement between the concerns. Celanese Corp., also licensed by Phillips, said that any comment on the new development should come from the licensing company. Hercules Powder and Bakelite are making a study of the situation. Koppers and Dow are building plants for production of the material, while Eastman Kodak and Spencer Chemical have announced plans to produce the plastic. Standard Oil Co. (Ind.) made no statement.

The nation's present production capacity is estimated at 180 million pounds a year. Industry authorities believe that this will rise to 230 million pounds a year by the end of 1958 and at least 500 million pounds by 1960.

DuPont's announcement said that its patent was based on the company's discovery of linear polyethylene more than ten years ago as part of its fundamental research program. The patent is one of a group of ethylene polymerization patents applied for during the years 1947 to 1950 and recently granted. They resulted from research work in the company's central research department by Arthur W. Larcher, Donald C. Pease and Milton J. Roedel. The company states that linear polyethylene has been a "clearly specified objective of DuPont research since the middle 1930's, and that the company has spent more than $6,500,000 on that objective.

A DuPont spokesman states "Throughout the period of patent office prosecution [legal effort], the DuPont Co. maintained that linear polyethylene, which was described in detail in DuPont's original patent application filed more than 10 years ago, differs radically in chemical and physical structure and in utility from the most closely related materials known previously, such as the flexible polyethylene used in squeeze bottles."

Dow Obtains License Option

► Dow Chemical Co., Midland, Mich., has obtained an option from the French Societe Polyplastic for a license covering the firm's United States and Canadian patent rights on a new method to obtain graft copolymers. The process is based on the pre-treatment of polymers by ozone, followed by grafting polymerization of vinyl, vinylidene and diene monomers induced by the ozonized polymers. The French organization claims that even polymers well known for their relative ozone resistance, induced polymerization of monomers when they were first submitted to the ozone treatment. No monomeric polymerization-catalyst is added for the grafting reaction, which enables the process to give graft copolymers that are practically free from homopolymers. A large variety of new graft copolymer resins and rubber could be so obtained which are definitively different from the "transfer" grafted copolymers obtained by using monomeric polymerization catalysts. The process can also be applied to surface grafting on finished polymeric products. Synthetic fibers made from polyacrylonitrile, polypropylene or polyethylene could be made dye-receptive by such treatment, it is claimed.

45,000 on Synthetic Plant Planned By German Firm

► Chemishe Werke Huels, a division of I. G. Farben before that trust was broken up, is constructing a plant for the production of synthetic rubber in Marl, Germany, with the assistance of the Firestone Tire & Rubber Co., Akron, Ohio. Through "agreements on licenses and the exchange of experience", Firestone has provided help in the design of some units of the plant, current reports say. Huels will use a process of its own for synthetic rubber manufacture as well as techniques of the Houdry Process Corp., Philadelphia, Penna., and the Esso Research and Engineering Co., Rahway, N. J.

To be in service by the middle of 1958, annual production at the plant is expected to be 38,000 tons of butadiene and 45,000 tons of synthetic rubber, enough to supply Germany's need. Capacity will be 90,000 tons of rubber.

Huels Plant History

The original Huels plant, at which synthetic rubber was produced during the war, was built in 1938. In 1953, when the government of West Germany encouraged the company to make this product again, it was found that the process previously used produced a rubber at almost twice the cost of natural rubber or of the synthetic product developed in the United States. Huels had discovered and patented another process during the war, but had not used it. With the help of the Houdry technique for making butadiene and the Esso process for concentrating butadiene, a new approach was made and the plant designed.

As the facility now stands, a new skyscraper laboratory is the focal point, with the plant spreading out below. At one side is a railroad yard which has traffic of about 1,000 freight cars moving in and out daily. Coal, at the rate of 2,500 tons a day, comes from a nearby mine. A 204,000 kilowatt power plant is centrally located and a new power unit stands nearby. Across from the railroad yards are retorts and stills of a chemical works which uses nearly 400 miles of pipe. In the heart of the works, seventeen arc furnace units split methane gas into acetylene and hydrogen.

The plant produces sixty products including plastics and pure chemicals. Highly automated, one battery of retorts stands without a man in sight and produces 1,500 tons of ethylene oxide monthly. Operations are run from a brick building 100 feet from the plant.

Ownership of New Facility

The synthetic rubber plant is owned by a new company, Bunawerke Huels. Owners in addition to Chemische Werke Huels, are three other big successors of I. G. Farben. These are Badische Anilin and Soda Fabrik of Ludwigshafen, Farbenfabriken Bayer of Levukusen and Farbwerke Hoechst. The plant is being built by the Engineering Department of Huels.

Bunawerke Huels set up a company in Brazil last year, which is called Quimica Industrial Huels do Brasil Ltda. This Brazilian firm participates in Companhia Brasileira de Estireno. Other companies with a share in Estireno are Koppers, Pittsburgh, and Firestone.

Budd E. Pollak

Richard P. Houlihan

Gavitt Wire Names New Officers

► The appointment of Budd E. Pollak as president and Richard P. Houlihan as vice-president of the Gavitt Wire and Cable Co. has been announced by V. T. Norton, president of the Amerace Corp. of which Gavitt is a division. Gavitt's executive offices are at Brookfield, Mass. Plants are located in Brookfield and West Brookfield, Mass. and at Escondido, Calif. Mr. Pollak, who retains his position as secretary of the parent company, was previously executive vice-president of Pequanoc Rubber Co., another Amerace divison. He graduated from Harvard University in 1932 and was with J. & W. Seligman & Co. and Union Securities Corp. in New York prior to service in the War Production Board and the U. S. Navy in World War II. After service in the Philippines and Okinawa, he joined American Hard Rubber Co. in 1946 and since 1949 has been secretary of that company and its successor, the newly organized Amerace Corp.

Mr. Houlihan, who has been general manager of Gavitt since 1954, graduated from Worcester Polytechnic Institute as an electrical engineer. After experience with Westinghouse Electric, Erie Resistor Corp., and United American Bosch Corp., he joined Gavitt Wire and Cable Co. in 1936. With the exception of the war years, when he served with the U. S. Marine Corps in the Pacific Theatre and in Washington, Mr. Houlihan has been with Gavitt.

U. S. Rubber Buys Rogers

► U. S. Rubber Co., New York, N. Y., has announced the purchase of the Rogers Super Tread Tire Co., Yakima, Wash. The company states that Rogers, a pioneer in the retreading of giant off-the-road tires, was acquired mainly to tie in with the facilities of U. S. Rubber tire dealers across the country who are servicing the tire needs of the highway and heavy construction industry. The newly purchased facility will also be used as a training center for personnel of the rubber company and tire dealers. Rogers will continue to operate under its own name and organization. L. C. Rogers, founder and former owner, is retiring from active business, but will remain as a consultant. E. S. Morgan, former U. S. Rubber truck tire sales manager in the Pacific Northwest, has been appointed general manager of the operation.

Mexican Titanium Dioxide Plant

► A plant for the production of titanium dioxide will be constructed in the state of Veracruz by Industrias Quimicas Asicas de Mexico, S. A. The manufacturing process, plant design and technical assistance necessary for the construction, installation and operation of the plant will be supplied by the Glidden Co., Baltimore, Md. Inquibamex engineers have been working at the Glidden plant in Baltimore for several months. Initial capacity of the new plant will be 8,000 tons per year with a reserve for an increase to 12,000 tons. The Inquibamex plant will include a sulfuric acid unit with a capacity of 100 tons a day. Ilmenite and sulfur, both of Mexican origin, will be used as raw materials. The plant is expected to be in operation at the end of 1958. Output will cover the requirements of Mexican industries and allow for export. Entirely owned by Mexican interests, the venture is said to involve a capital investment of $6.5 million. Nacional Financiera, S. A., the government's banking institution, is a minority stockholder, along with private Mexican capital. Nacional Financiera guarantees credit obtained by the company for machinery purchases.

ASME Rubber and Plastics Division Holds Two-Day Meeting in New York

Morning and Afternoon Technical Sessions Highlight Meeting Activities

► The Rubber and Plastics Division of the American Society of Mechanical Engineers met on December 4 and 5 at the Sheraton-McAlpin Hotel in New York City in conjunction with the Annual Meeting of the parent body which was held during the week of December 1. The Rubber and Plastics Division meeting was divided into four sessions, one each in the morning and afternoon on December 4 and 5.

A brief business session was held during a combined luncheon attended by members of the Executive, Advisory and General Committees of the Division, with Fred Wehmer (Minnesota Mining), chairman of the Division for 1957, presiding. Howard Adams (Monsanto) presented the annual report on Division activities and this was followed by reports from the various committee members.

George L. Bruggemeier (Firestone), reported on activities of the ASA Safety Committee, while Mr. Wehmer reported on the ASME Safety Liaison Committee. R. G. Seaman *(Rubber World)*, discussed the activities of the ASME Professional Division Committee, and Dr. R. D. Stiehler (National Bureau of Standards) read a report prepared by Dr. Gordon Kline of NBS on the ASA Plastics Pipe Committee.

Elected to Executive Committee

It was announced at the meeting that Murray Longstreth (Dow Chemical) has been elected a member of the Executive Committee for 1958. Selby M. Skinner (Case Institute) has been named to succeed Mr. Longstreth as chairman of the Plastic Papers Committee.

Robert Barber (St. Regis Paper), secretary of the Rubber and Plastics Division, announced the results taken among the members of the General Committee to determine those members who wished to continue to serve and those who wished to withdraw. Also under discussion was the question of whether to change the name of the Division to the Rubber, Plastics and Adhesives Division. The number of papers contributed on the subject of adhesives will finally decide if such a name change will be adopted.

Mr. Barber, on behalf of the Division, extended thanks to Mr. Wehmer for his services as chairman and presented him with a rubber and plastic gavel, usually presented to retiring chairmen, and a Certificate of Appreciation from the Society.

In accordance with general procedure, Mr. Barber moves from his 1957 post as secretary of the Division to chairman for 1958. The 1958 secretary is Dr. Stiehler.

Mr. Seaman served as chairman at the first session of the Rubber and Plastics Division meeting held on the morning of December 4 assisted by Mr. Bruggemeier as vice-chairman. The first paper presented at the session was entitled "Designing Belts for Material Handling" by F. W. Blanchard (Hewitt-Robins). This paper described the engineering data and materials used in the design and production of rubber conveyor belting for bulk material handling. Particular emphasis was placed on the field of high tension belting and on recently developed design information resulting from research conducted by Pennsylvania State University under Hewitt-Robins sponsorship.

Discusses Passenger Conveyors

The next paper presented at the session was entitled "The Development of a Passenger Belt Conveyor System" by Paul W. Freitag, Jr. (Goodyear). The author discussed the desirability of continuous transportation systems in our business areas and showed how they lead to the development of a conveyor system. The operation of such a system was described along with a review of the technical problems involved.

"The Development of Air Springs and Their Application to Automotive, Aircraft, and Industrial Uses" was the title of the paper presented by H. H. Deist (Firestone). This paper provided a summary of the history and development of air springs from the early 1930's to date, including aircraft, automotive and industrial applications. General principles and theory were discussed.

The final paper at the morning session was presented by M. O. Beck (Lord Mfg.) who spoke on "Rubber for Pivots in Heavy Duty Vehicles."

R. W. Barber presided at the session held in the afternoon of December 4 with Mr. Longstreth as vice-chairman. The first paper presented at this session was entitled "Tensile Behavior of Reinforced Plastic Laminations and Composite Plates" by Rolf L. Thorkildsen (General Electric). This paper offered data on equations and curves which have been obtained which describe the elastic tensile behavior of orthotropic laminations and composite plates that are loaded in arbitrary directions.

"Prediction of Creep in Bending from Tension and Compression Creep Date When Creep Coefficients are Unequal" was the title of the paper presented by W. N. Findley (Cook Research Laboratories) and Prem N. Mathur (Ford Motor). It was stated that the method of predicting creep in bending from date on creep in tension has been extended to the prediction of creep in bending when the creep in tension and compression are unequal and when the time-dependent and time-independent stress functions are unequal.

"The Initiation of Necking and Its Effect on the Tensile Behavior of Polyethylene" was the title of the last paper presented at the afternoon session by Mr. Skinner and by Masao Nakamura (Case Institute).

Mr. Wehmer served as chairman of the session held on the morning of December 5 with Mr. Stiehler as vice-chairman. Robert P. Whittier (Monsanto) presented the first paper at this session, entitled "Design and Evaluation of the Plastics House of the Future." This paper reviewed the design of the "Monsanto House of the Future" relative to the selection of materials, shapes, thickness of the parts, and several of the loading studies.

D. A. Stivers, Joseph F. Abere and L. J. Wallgren (Minnesota Mining) and P. J. Stedry (North American Aviation) presented the next paper at the session, this one on "3M Brand Fluoro-Rubber 1F4." The authors stated that this new material has given outstanding service in solvents, hot fuels, lubricating oils and hydraulic fluids used in many industrial and military applications.

The last paper at the morning session on December 5 was entitled "Teflon 100X Perfluorocarbon Resin Properties and Applications" by John C. Siegle (DuPont). The author described the new resin which, he said, is the result of extensive experimentation to develop a completely fluorinated polymer which can be fabricated into various shapes and forms by melt techniques.

Final Session Papers

M. E. Lerner (RUBBER AGE) served as chairman of the final session of the Rubber and Plastics Division Meeting held in the afternoon on December 5. He was assisted by Mr. Adams as vice-chairman. The first paper presented at this session was on the subject "A High Shear Rate Capillary Rheometer for Polymer Melts" by Edmund H. Merz and Robert E. Colwell (Monsanto). The authors disclosed that an instrument has been developed to measure the flow characteristics of polymer melts at shearing rates over the range of 1-10,000 reciprocal seconds and over the temperature range 70-700°F. The derived flow parameters are independent of capillary length and diameter. The application of some results obtained with this rheometer to polymer processing problems was discussed.

Henry J. Karam (Dow Chemical) followed with his paper on "Simplified Plastics Testing Procedures" and was, in turn, followed by E. E. McSweeney and R. G. Heiligmann (Battelle Memorial Institute) who presented their paper on "A Review of Developments in Plastics Engineering—1956-57." This paper reviewed significant developments in the field of plastics for the year ended June 30, 1957. New Developments were discussed, as well as progress in established areas.

Foam Products Standardization Discussed at NFM Meeting

► At a meeting of the National Furniture Manufacturers, held in Chicago, August 27, 1957, Pitt B. Harris, general sales manager of the Foam Products Division for Hewitt-Robins, Inc., Stamford, Conn., discussed "Standardization of Size and Contour of Latex Foam Cushions". According to Mr. Harris, both latex foam manufacturers, whom he represented, and furniture manufacturers were concerned with the "vanity and comfort of the human body in its various angles of repose and with manufacturing and selling the instruments to those ends . . ." He felt that through cooperation, both industries might profit, and presented for consideration a proposal to standardize design in latex foam cushions.

Though standardization in this field could not be carried out to its ultimate and ideal conclusion, there would be several instances where standardization and individuality could be compatible. The automobile and housing industries were specified as examples of industries where a great deal of standardization had taken place without sacrifice to style and variation.

Cites Six Factors

Six factors enumerated that should be taken into consideration in this type of program were: (1) Front to back dimension; (2) Side to side dimension; (3) Crown; (4) Box; (5) Contour, and (6) Shape. All of these dimensions could not be standardized completely. However, Mr. Harris felt that the furniture and latex foam industries had "refined their dimensions a little too much for economy and utility".

He suggested the disposal of the 15/16, 3/8, 7/16 and 15/32 cushion dimensions. Even inch dimensions in certain sizes and ½ inch dimensions in other sizes should be kept. Standards would be based on the popular 5⅛ and 4¼ inch crown sizes. Suggestions, based on research by a committee within the latex foam industry were: the reduction of the number of completely different contours in the 5⅛ inch crown from 12 to 1 and in the 4¼ inch crown from 9 to 1. Through this modification, the number of contours classified as standard in the more popular crowns would be cut from 21 to 2.

Also proposed were: elimination of the number of fraction sizes in cushions under 21 inches; elimination of increments other than ½ inch in those between 21 and 25 inches; confinement to one inch of increments in the 25 inch and up sizes; limitation of size dimensions to variances of ¼ inch on cushion ears; standard flare; standard rear contour and, finally, standard corners.

These would be industry wide standards that would include flares on the corners to insure good tailoring and make it easier for designers to plan furniture that could be produced with less time and labor. At present, he stated, you can't mix cushions from two manufacturers. The same situation prevails in the thinner cushions. For the furniture manufacturer, this situation borders on the chaotic and for the foam rubber industry, it means keeping an inventory of more than 7,000 molds, when a few hundred would do the basic job as well.

Four advantages in the adoption of standardization in foam rubber cushions would be: (1) Interchangeability of cushions from any manufacturer; (2) Faster delivery of cushions because foam rubber manufacturers could reduce their inventory of molds. This would also enable the replenishing of stocks through local sources and help avoid the risk of seasonal shortages; (3) Greater design potential would be possible as standard contours would evolve into the availability of more shapes from more manufacturers; (4) Increased production through simplifications effected throughout the cushion department of the plant.

Savings Through Standardization

Mr. Harris stressed that investigation had shown that literally millions of dollars had been saved where standardization had been employed. He gave as examples Westinghouse, Remington Arms and DuPont, all of which had effected large savings through standardization of some of their products. It would take time to bring about standardization, he explained, "But gradually, we think a standard design, contour and size could be developed so that, over a period of time, the advantages would be completely felt throughout all phases of the industry".

In closing, he asked the cooperation of the audience by a mutual adoption of the standards that had been presented and a questionaire was circulated to ascertain the feelings of the furniture manufacturers. Mr. Harris urged that the latex foam and furniture industries work together through a joint committee to thoroughly explore the proposal.

Fairprene Balloons Raise New Building

► Inflated coated fabric "balloons" are being utilized for construction purposes by the Kaiser Aluminum and Chemical Corp., Oakland, Calif. Two balloons made of DuPont "Fairprene" were recently used to raise the first factory to be housed in a stressed skin aluminum dome. The balloons are coated on the outside with Hypalon and on the inside with neoprene. Placed one on top of the other underneath several aluminum panels forming the dome's crown, the balloons were inflated to raise the dome shell as additional panels were added. This method permitted work crews to fasten all the panels at ground level. The factory is located in Abilene, Kansas, and was erected for the Fi Fo Conveyor Co., a division of Vacu-Blast Co., Inc., Belmont, Calif., by Kaiser Aluminum and Chemical Corp. Erection of the factory at Abilene was completed by 28 men in 22 hours.

Acquires Complete Control

► National Distillers & Chemical Corp. has acquired the minority interest of Panhandle Eastern Pipe Line Co. in National Petro-Chemicals Corp., of which 60 per cent was previously owned by National Distillers and 40 per cent by Panhandle. Directors of both firms approved the transaction which was to have been completed before the end of the year. Under the terms announced, the transaction was to have involved the exchange by Panhandle of its 40 per cent interest in Petro-Chemicals for 1,500,000 shares of National Distillers' common stock. The company says that the complete acquisition of Petro-Chemicals by National Distillers was made desirable by the continued expansion of National Petro-Chemicals. National Petro-Chemicals will be a wholly-owned subsidiary of National Distillers operated through the U. S. Industrial Chemicals Co. Division.

Panel on Quality Control at the Southern Rubber Group Meeting

Southern Rubber Group Holds Fall Meeting

Two-Day Meeting Features Panel Discussions on "Adhesives and Bonding" and "Standard Quality Control and Rubber Grading"

► The Fall Meeting of the Southern Rubber Group held on November 15 and 16 at the Peabody Hotel in Memphis, Tenn., was attended by approximately 280 representatives of the rubber industry some sixty of whom were accompanied by their wives. Two panel discussions were held, one on each of the two meeting days. The panel discussion on November 15th was devoted to the subject of adhesives and bonding, while the session on the following day concerned itself with standard quality control and rubber grading. A question and answer period followed each of the two panel discussions.

It was decided at a business meeting to change the business year of the Southern Rubber Group to end on July 1 rather than on November 1 of each year. This change will enable the new officers to take over after the conclusion of the Spring Meeting and plan for the Fall Meeting.

The meeting banquet was attended by over 350 members and guests. J. R. Galloway (DuPont) served as master of ceremonies. E. T. Skinner (Skinner Bros.) delivered a talk on "You Too Can Be a Millionaire." Lenoir Black (C. P. Hall), a member of the Group's Education Committee introduced Leslie Drane, Jr., and presented him with the first Harmon Connell Memorial Scholarship.

Theory of Rubber Adhesion

The moderator of the first panel discussion was Harold Gross (General Adhesives). The panel included Dr. Frank Wetzel (Hercules Powder) who spoke on the "Theory of Rubber Adhesion With Emphasis on Rosin and Rosin Derivatives in Pressure-Sensitive Adhesives." The speaker observed that pressure-sensitive adhesives and solvent and latex cements represent the major portion of adhesives containing unvulcanized elastomers. Such adhesives, he stated, are usually composed of an elastomer and a resin tackifier plus various modifiers, such as fillers, plasticizers, and stabilizers.

The speaker went on to discuss the effects of various types of resins and resin derivatives in pressure-sensitive adhesives. He also discussed research tools which have been developed to objectively measure certain adhesive properties. It is to be hoped, he said, that the findings will be roughly applicable to solvent and latex systems and that the techniques will apply with some modification to solvent and latex systems.

The next speaker at the panel discussion was E. L. Borg (Naugatuck Chemical) who discussed "Latex Tire Cord Adhesives." Mr. Borg stated that in practice, tire cord is solution treated with rubber and other materials for two reasons. First, the adhesive which is deposited on the cords from the solution acts as a tie coat to strengthen the bond between the tire cord and the carcass rubber. This results in a stronger tire less likely to develop ply separation. Second, the adhesive serves to keep the cords separated in the weftless fabrics used in carcass construction. This prevents chafing and reduces cord abrasion and failure.

Mr. Borg discussed the history of tire cord adhesives and touched upon the problems encountered with rayon and nylon cord. He also discussed the cord

These Panel Members Discussed Adhesives and Bonding

dipping process and the manner in which the adhesive bond is measured. He stated that new tire cord materials and tire constructions have complicated the matter of tire cord adhesion. Variations of vinyl pyridine and resorcinol formaldehyde treatment still do a satisfactory job, Mr. Borg declared.

Lee L. Blyler (Howe & French) spoke on "General Adhesive Applications With Emphasis on the Shoe, Flooring and Automotive Industries." The speaker first defined mechanical adhesion as occurring when the surface or adherend to which the adhesive is applied is so abraded that it is, in effect, a multitude of irregularly shaped jagged holes and projections. When the adhesive is applied, it flows in and around these holes and projections and cures to form an interlocking joint with the surface and adhesive one interlocking unit. Specific adhesion, on the other hand, does not depend upon simple interlocking or surface and adhesive. It comprises chemical or physical forces between the adhesive and the adherend with such an attraction that attachment occurs regardless of whether the surface is rough or smooth.

Shoe Adhesive Problems

Mr. Blyler, in discussing adhesives in the shoe industry, described some of the specific problems in this field and the types of adhesives which have been developed to meet these problems. The problems of adhesives in flooring, he stated, are quite different from those encountered in the shoe industry. He went on to discuss the types of adhesives used in connection with asphalt, vinyl, rubber and other forms of flooring.

Mr. Blyler characterized the adhesives used in the automotive industry as either sealants or structural types. Where the adhesive must function as a structural member, either air cured or heat cured adhesives are used. In those cases where the bond is not stressed, such as in weatherstripping, etc., pressure sensitive adhesives of butyl or neoprene are generally used.

The final speaker at the panel discussion was Stewart L. Brams (Dayton Chemical Products Laboratories), who discussed "Rubber-to-Metal Bonding—A 1957 Inventory." Mr. Brams stressed the importance of metal preparation and discussed adhesion methods, compounding and testing and the theories involved. Practical experience, he stated, is still the key to success in bonding. The art is still highly empirical, and still resists all efforts to reduce it to an exact science.

The second panel discussion, devoted to quality control and rubber grading, was presided over by J. H. Sparks (Robbins Floor Products). O. R. Weaver (Phillips Chemical), for his part in the discussion, spoke on "An Introduction to the Theory of Quality Control." Mr. Weaver described the "laws of probability" and illustrated how they can be applied to quality control in the rubber industry.

Leonard Freeman (Goodrich) described "A Method for the Application of Statistical Quality Control in the Manufacture of Rubber Products," by relating the manner in which Goodrich carries on its quality control program in plants throughout the world. He showed how statistical quality control aids technicians in pinpointing problems and how it provides engineers with information so that improved specifications and processes can be developed.

Sidney J. Pike (S. J. Pike Co.) in describing "Rubber Grading" exhibited color slides illustrating the production of plantation and native rubber and its grading. The slides depicted activities in Hong Kong, Viet-Nam, Cambodia, Malaya, Singapore, Java, Sumatra and Ceylon.

Following the meeting, some 300 group members and their guests attended the Mississippi-Tennessee football game.

Fasson Technical Center Opened

► Fasson Products has announced the opening of a new Technical Center and general offices building in Painesville, Ohio, for research on self-adhesive materials. A spokesman states that the company is now exploring the whole area of chemical fastening. Fasson sales are divided between self-adhesive materials for the graphic arts field and self-adhesive decorative materials for the hard goods manufacturing industries. Of modern construction, the new laboratories are completely equipped with the latest testing and experimental equipment. They are specially ventilated and air conditioned for working with the volatile and explosive materials used in making pressure sensitive adhesives. The new building contains a sample room with over 2,000 different self-adhesive materials.

High-Purity Aromatics Plant

► Jones & Laughlin has announced the production of benzene, toluene and xylenes, said to be of higher purity than have been produced from any other source, at a new plant in Aliquippa, Penna. Built by the Badger Manufacturing Co., Cambridge, Mass., the plant pioneers the application for coal chemical operations of Esso's Hydrofining Process combined with the Udex Process of the Universal Oil Products Co. The new plant is also said to be the first combination of coal oil purification process and Udex separation on stream in America. A Badger spokesman states that the Aliquippa plant boasts streamlined process advantages such as a control house completely integrated with other process units and the substitution of hydrogenation for the conventional acid washing step, which is said to eliminate a source of high maintenance cost while increasing the amount of product recovered.

Consolidates Athens Subsidiary

► Athens Machine Co., subsidiary of the Bridgwater Machine Co., Akron, Ohio, has been consolidated into the parent firm and its name changed to the Tire and Mold Division of Bridgwater Machine. At the same time, three changes were made in the firm's official staff. John W. Bridgwater, formerly treasurer, has been named executive vice-president. Frank M. Batdorff, who was assistant treasurer, has been appointed vice-president and assistant factory manager at Athens. James Steedman, also former assistant treasurer, has been named treasurer. Other officers are Frank A. Buechler, vice-president in charge of production of the Akron plant; A. J. Slatter, vice-president and factory manager at Athens; W. M. Mapes, vice-president in charge of sales, and Jessie G. Bridgwater, secretary.

To Centralize Sundries Manufacture

► B. F. Goodrich Industrial Products Co., Akron, Ohio, has announced plans to centralize the manufacture of molded rubber sundries at its main plant in Akron. It is believed that the consolidation will result in economies in floor space expenses, costs of power and supplies, and reduced needs in a number of manufacturing services. An improvement in distribution service is anticipated and more efficient operation will be provided as sundries manufacturing supervision and technical operations will be brought under one group. The move of equipment and other facilities is expected to take 12 months with no interruption in production or service.

Thomas Named Battelle President

► Dr. B. D. Thomas, scientist and research administrator, has been named president of Battelle Memorial Institute succeeding Dr. Clyde Williams, who recently retired. Active head of Battelle since being named a director a year ago, Dr. Thomas joined the organization in 1934 as a research engineer. He was appointed assistant director in 1942 and a vice-president in 1955. Along with scientific and technical activities, Dr. Thomas has carried administrative responsibilities. He established and headed the organization's first Division of Chemical Research in 1939 and was a key figure in the establishment of the organization's research laboratories in Frankfurt, Germany, and Geneva, Switzerland. Dr. Thomas has published several papers in physical chemistry and on methods of separating, sorting and concentrating of minerals. A holder of several patents, Dr. Thomas has also written and lectured on research management and the philosophy of science and research.

Dr. Thomas is a graduate of the University of Washington, receiving a B. S. degree in 1929 and a Ph. D. in 1933. While there, he was awarded a DuPont fellowship in chemistry. He is a member of Phi Lambda Upsilon and Sigma Xi, honorary chemistry and scientific research societies respectively. Last year, he was granted the honorary degree of Doctor of Engineering by the Michigan College of Mining and Technology "in recognition of high attainments in engineering".

Kenrich Kenplast RRNS

► Kenrich Corp., Maspeth, N. Y., has developed a new product called "Kenplast RRNS", a processing oil which is said to improve freeze resistance, have excellent color, ultra-violet light stability and a low pour point. The new material is suitable for use with both natural rubber and various synthetics. The company has issued a bulletin describing the product which contains complete physical and chemical properties of the material as well as compounding data.

California Lecture Series

► A course in Elementary Rubber Technology was given by the Northern California Rubber Group on Tuesday evenings from September 24 to November 26 at the University of California, Berkeley, Calif. Sponsored by the University's Department of Chemical Engineering, the course consisted of ten lectures, each presented by a different member of the Rubber Group. About 55 persons attended.

Rubatex Announces Expansion

► Rubatex Division of Great American Industries, Inc., Elyria, Ohio, has announced an expansion program which is expected to cost $1 million. Robert A. Pritzker, president of the parent company, said the program was the largest in the division's history.

Norman E. Hathaway

Elected Marketing Vice-President

► Oronite Chemical Co., San Francisco, Calif., has announced the election of Norman E. Hathaway, formerly general sales manager, as director and vice-president—marketing, succeeding Milton L. Baker, who has retired. Headquarters will continue to be at Oronite's home office in San Francisco. Mr. Hathaway joined Oronite in 1954. Prior to this, he was director of the Chemical and Rubber Division, Business and Defense Services Administration, Department of Commerce in Washington, D. C. During World War II, he served as a commissioned officer in the U. S. Navy submarine service. Mr. Hathaway is a native of Corvallis, Ore., and was graduated from the University of Maryland with a degree in chemical engineering.

To Produce High Purity Propylene

► Sinclair Chemicals, Inc., New York, N. Y., has announced the initiation of a program to expand its petrochemical activities by marketing high purity propylene. The propylene will be produced in a new petrochemical plant at the Marcus Hook, Penna., refinery of Sinclair Refining Co. This new facility, which will shortly be in full scale operation, will be the first high-purity propylene plant constructed in North America specifically for the manufacture of plastic grade propylene and will constitute the source of raw material for the new polypropylene plastic plant recently announced by the Hercules Powder Co.

Pequanoc Not To Rebuild

► Amerace Corp., New York, N. Y., has announced that the company's wholly-owned subsidiary, the Pequanoc Rubber Co., will not rebuild its reclaim and compounding facilities at Butler, N. J., which were destroyed by fire last February. The company states that this decision will not affect Pequanoc's new compounding plant in Tallapoosa, Ga., which will continue to produce and sell compounds.

Two Cabot Appointments Announced

► Godfrey L. Cabot, Inc., Boston, Mass., has appointed Harry Collyer to the Boston office as manager of foreign technical service and Edward Eaton to the Paris, France, office as resident European technical manager. Mr. Collyer was graduated from Tufts College in 1937 with a B.S. in chemical engineering. In 1942, he served as research assistant at the Massachusetts Institute of Technology, doing some of the original work on the reclaiming process for synthetic rubbers. He then joined the Cabot organization as manager of the rubber testing laboratory. In 1950, he was appointed manager of the technical laboratory of Cabot Carbon, Ltd., Ellesmere Port, England, and returned to Boston in 1952 as manager of technical service for Godfrey L. Cabot, Inc. In 1954, he returned to England as Cabot's European technical manager. Mr. Eaton received a B.S. degree in chemical engineering from Northeastern University in 1943. Before joining Cabot, he worked in the rubber industry where he gained experience in process and product development, rubber chemistry and tire compounding. He joined the Technical Department of Godfrey L. Cabot, Inc., Boston, in 1953. In 1954, he was transferred to Pampa, Texas, as technical representative in the Southwest area.

Goodyear Develops Chemigum N8

► Chemical Division of the Goodyear Tire & Rubber Co., Akron, Ohio, has developed "Chemigum N8", a new medium acrylonitrile content rubber designed to meet the need for a nitrile polymer exhibiting low nerve and shrinkage characteristics. Applicable to extrusion and calendering operations, the new synthetic rubber is said to demonstrate excellent mill breakdown properties and to accept pigment readily. It is stabilized with a non-staining antioxidant which supplements the good color of the base polymer. According to the company, substitution or blends of Chemigum N8 in existing compounds produces higher modulus, lower elongations, exceptional hardness and compression set, promotes smooth calendering, good mold flow and excellent die reproductions, even in the 40 to 50 Shore A hardness range. Now available on a commercial scale, Chemigum N8 is packaged in 50 pound bales.

Wyandotte Extends Chemical Line

► Wyandotte Chemicals Corp. has announced plans for the construction of a new propylene oxide plant at the company's Wyandotte, Mich., works. Full scale operation is expected to begin early in the second quarter of 1958. The new plant will utilize the chlorohydrin process and will produce propylene dichloride and dichloroisopropylether along with propylene oxide. Plant capacity has been planned to permit Wyandotte's entrance into the commercial propylene oxide market and to handle its captive uses. The material will be available for purchase in tank car quantities.

Albert-Harris Plant Reopened

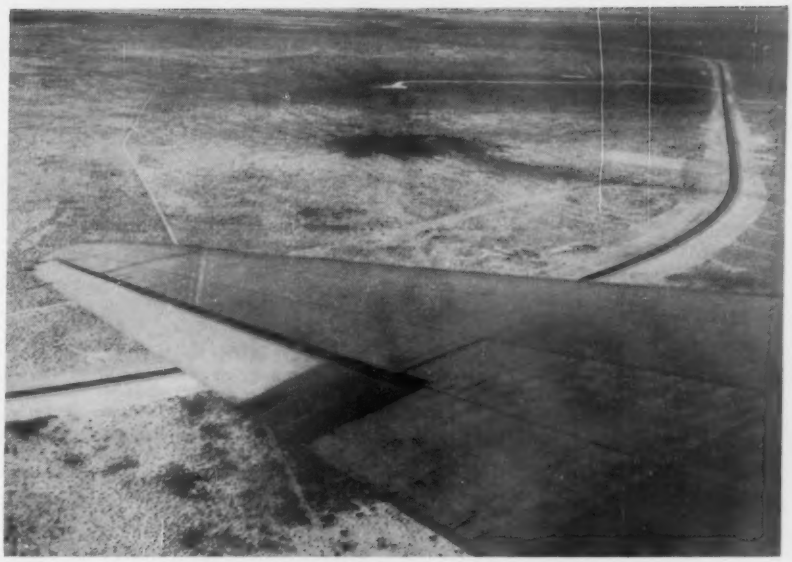
► Albert-Harris Co., Akron, Ohio, has been granted permission to operate temporarily under a receiver. The decision was made on December 12, after hearings in Common Pleas Court in Akron, on two motions filed by Edward J. Harris, president and one of the co-owners of the firm. Sidney L. Albert had been awarded receivership of the company on December 4 by Judge Ray B. Watters, who ordered that the company's Bettes Corners plant be turned over to Attorney Clair E. Whitmer. The receivership action was taken to bring to a head the deadlock between Mr. Albert and Mr. Harris in a dispute which began early last year. An injunction was brought against Mr. Harris and Dr. Adolph Frohlich by Col. Harold M. Reedall, a stockholder of Albert-Harris & Co., asking that they be enjoined from using and benefitting from patents and machines owned by the company. It was Col. Reedall's contention that the patents were owned by Albert-Harris, not by Harris or the Goodride Tire Co., which is owned by Mr. Harris alone. Mr. Harris claimed that Col. Reedall's suit had been inspired by Mr. Albert. On December 10, Mr. Harris filed a petition asking common pleas court to permit operations under a receiver. Through his attorney, Anthony Lombardi, Mr. Harris declared that operation of the plant until such time as the firm was dissolved would be beneficial to the corporation as well as to the creditors. Dissolution hearings were scheduled to have been held on January 2.

Sevin Joins Baker Castor Oil

► Henry J. Sevin has been named New England sales representative for the Baker Castor Oil Co., Bayonne, N. J., succeeding Joseph C. Kay who has retired. Mr. Sevin has been a sales representative for Chas. Pfizer & Co. for the last five years. Previously, he was a quality control chemist at that company's Groton, Conn., plant. He received a B.S. degree in chemistry from the University of Connecticut. During World War II, Mr. Sevin served as a radarman in the U. S. Navy. Mr. Kay is a graduate of Columbia University College of Engineering. From 1914 to 1926, he was assistant superintendent of Spencer Kellogg's Edgewater, N. J., plant. He managed the Castor Oil Division of Berkshire Chemical Co. at Bridgeport, Conn., from 1926 to 1946. Since 1946, he had been associated with the Baker sales organization.

Thornton Emmons Retires

► Thornton Emmons, vice-president and director of American Zinc, Lead and Smelting Co., has retired from active duty. He will continue as a consultant and director of the company for an indefinite period. Mr. Emmons joined the American Zinc sales organization in New York City in 1915. He was transferred to Columbus, Ohio, in 1921 as a district manager of sales and served in that capacity until 1930. From 1930 to 1955, he served as vice-president in charge of sales.



Aerial View of the Test Track at the Proving Grounds

Firestone Opens Tire Proving Grounds

New Automobile Track and Tire Proving Grounds at Fort Stockton Provide New Testing Facilities For the Company . . .

► What is said to be the world's largest automobile track and tire proving grounds was opened on December 3 at Fort Stockton, Texas, by the Firestone Tire & Rubber Co. The company maintains that the 7.712 mile track is the largest built for either racing or testing. More than 65 technicians are employed at the Test Center, placing their stamp of approval on all tires developed for eventual use by the public. The Test Center is located 12 miles west of Fort Stockton near the southwest border of Texas.

The Fort Stockton operation is the latest test phase added to an already extensive testing program. Indoor testing, special fleets of cars and trucks and the new test track round out the firm's test program. Millions of miles are recorded on all types of test vehicles. Cars and trucks assigned to Fort Stockton will log approximately 18,000,000 tire miles each year.

Four automobile fleets are maintained to test tires under a variety of conditions. The fifth phase is conducted in the laboratory, the sixth on race tracks such as the Indianapolis 500-mile Speedway and the track at Monza, Italy, and the final phase at Fort Stockton.

The test track at Fort Stockton is divided into three 12-foot lanes. The outside lane is reserved for high speed runs and the middle and inside lanes are used for moderate and low speed runs.

In opening the new Test Center, Firestone announced a number of new tires which have been added to the company's line. The first of these is the "Steelcord" truck tire. The body of this tire is constructed of steel cord instead of fabric. Also introduced, was a new safety tire which is a refinement of the company's "Supreme" tire. The new casing, the "Supreme Safety Airlock", features a built-in spare which functions the same as an ordinary tire. The inner chamber supports the car in the event the outer casing is deflated.

Firestone has also introduced a new concept in tires, the "Perma Spare", a unit that involves a rubber rimmed steel wheel. When a motorist has a flat tire he removes the lugs holding the wheel and slips the Perma Spare disc on over the tire and replaces the lugs. With the Perma Space in place, the motorist can continue his trip until he reaches a place where the flat tire can be repaired.

A big advantage of the rubber rimmed steel unit is the fact that it is narrow in width, thus taking up very little trunk room. The Perma Spare can be driven for a maximum of 100 miles at speeds up to 45 mph.

IRI Plans Conference On Polymer Technology Progress

► "Recent Advances in Polymer Technology" will be the topic of a joint conference to be held by the Institution of the Rubber Industry and the Plastics Institute on Thursday, February 27, 1958. The meeting will be held in the building of the Institution of Civil Engineers, Great George St., Westminster, S. W. 1, London, England. Registration forms may be obtained from the secretary of either of the two sponsoring groups; G. E. Holmes-Siedle, Institution of the Rubber Industry, 4 Kensington Palace Gardens, London W. 8, or J. N. Ratcliffe, Secretary to Council, Plastics Institute, 6 Mandeville Place, London, W. 1. The following papers will be presented to the group:

"Recent Advances in Polymerization Techniques", by H. W. Melville (Department of Scientific and Industrial Research).

"Masterbatching Techniques", by H. A. Braendle (Columbian Carbon, U. S. A.).

"Preplasticizing Methods", by R. Schooley (R. H. Windsor Ltd.).

"Rubber/Resin Combinations", by Insitut Francais de Caoutchouc.

"Mastication Polymerization", by F. Watson (British Rubber Producers' Research Association).

"The Rubber-Like State", by Prof. G. Gee (University of Manchester).

"Radiation and Polymers", by Prof. A. Charlesby (Royal Military College of Science).

"Radiation Processing", by T. Bain (Tube Investments Research Laboratories).

"Urethane Foam Process", by J. T. Watts (I. C. I., Dyestuffs Division).

"Expanded P. V. C.", by F. Chapman (Whiffen & Sons Ltd.).

"Properties of Cellular Polymers", by A. Cooper (Expanded Rubber Co. Ltd.).

Afterwards, there will be a discussion of the last three topics.

Washington Marks 10th Year

► The Washington Rubber Group will celebrate its tenth anniversary on February 18 with an afternoon technical session followed by a reception and banquet. The afternoon session, scheduled for 4:00 to 5:30 p.m. and the banquet at 7:30 p.m. will be held in the National Press Club ballroom, Washington, D. C. The reception will be held at 6:30 p.m. in the East Lounge of the club. H. E. Humphreys, chairman of the U. S. Rubber Co., will be the decennial dinner speaker. The technical session will be addressed by Dr. Ray P. Dinsmore, research vice-president of the Goodyear Tire & Rubber Co., and Dr. Allen V. Asten, director of the National Bureau of Standards. Reservation requests should be addressed to Dr. A. W. Sloan, Atlantic Research Corp., 812 N. Fairfax St., Alexandria, Va. An illustrated 48 page decennial brochure containing the history of WRG will be issued to take the place of the customary WRG directory. During the meeting special awards will be made to the 62 charter members of the organization.

Coming Events in the Rubber Industry

Feb. 13. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Feb. 18. Washington Rubber Group, Decennial Meeting, National Press Club, Washington, D. C.

Feb. 21. Connecticut Rubber Group.

Feb. 21-22. Southern Rubber Group, Houston, Texas.

Mar. 20. Quebec Rubber and Plastics Group.

Mar. 28. New York Rubber Group, Spring Meeting, Henry Hudson Hotel, New York, N. Y.

April 10. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

April 11. Akron Rubber Group, Spring Meeting, Sheraton-Mayflower Hotel, Akron, Ohio.

April 16. Washington Rubber Group.

April 17. Quebec Rubber and Plastics Group.

April 25. Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

May 14-16. Division of Rubber Chemistry, A.C.S., Spring Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio.

May 21. Washington Rubber Group.

May 23. Connecticut Rubber Group.

June 5. New York Rubber Group, Summer Outing, Doerr's Grove, Milburn, N. J.

June 20. Akron Rubber Group, Summer Outing, Firestone Country Club, Akron, Ohio.

June 22-28. A.S.T.M. Annual Meeting, Hotel Statler, Boston, Mass.

Aug. 5. New York Rubber Group, Golf Outing, Wingfoot Golf Club, Mamaroneck, N. Y.

Sept. 6. Connecticut Rubber Group, Summer Outing.

Sept. 10-12. Division of Rubber Chemistry, A.C.S., Fall Meeting, Hotel Sherman, Chicago, Ill.

Oct. 17. New York Rubber Group, Fall Meeting, Henry Hudson Hotel, New York, N. Y.

Oct. 24. Philadelphia Rubber Group, Poor Richard Club, Philadelphia, Penna.

Nov. 14. Connecticut Rubber Group.

Nov. 17-21. Society of the Plastics Industry Annual National Conference, Morrison Hotel, Chicago, Ill.

Nov. 30-Dec. 5. A.S.M.E. Annual Meeting, Hotel Statler, New York, N. Y.

Dec. 12. New York Rubber Group, Xmas Party.

May 12-15, 1959. Division of Rubber Chemistry, A.C.S. Spring Meeting, Biltmore Hotel, Los Angeles, Calif.

Nov. 9-13, 1959. Joint International Meeting of Division of Rubber Chemistry, A.C.S.; Committee D-11, A.S.T.M., and Rubber and Plastics Division, A.S.M.E., Shoreham Hotel, Washington, D. C.

May 24-27, 1960. Division of Rubber Chemistry, A.C.S., Spring Meeting, Hotel Statler, Buffalo, N. Y.

Sept. 13-16, 1960. Division of Rubber Chemistry, A.C.S., Fall Meeting, Commodore Hotel, New York, N. Y.

May 16-19, 1961. Division of Rubber Chemistry, A.C.S., Spring Meeting, Brown Hotel, Louisville, Ky.

Sept. 5-8, 1961. Division of Rubber Chemistry, A.C.S., Fall Meeting, Hotel Sherman, Chicago, Ill.

May 15-18, 1962. Division of Rubber Chemistry, A.C.S., Spring Meeting, Hotel Statler, Boston, Mass.

To Build Moroccan Tire Plant

► General Tire & Rubber Co., Akron, Ohio, has completed an agreement with the Moroccan government which gives General Tire certain privileges toward the production of tires in that country. The agreement involves approximately 3,000,000,000 francs ($7,143,000). Abderrahim Bouabib, Moroccan Minister of Economy, has given the company the following guarantees: (1) No other company will have the right to manufacture tires in that country for the next five years; (2) The company will have the right to import, duty-free, equipment for setting up a tire factory, and (3) Raw materials imported for the manufacture of tires will be given special customs consideration.

To be located 10 miles north of Casablanca, construction of the plant will begin within the next two or three months. The factory is expected to go into production by the end of 1958 and will employ 500 Moroccan workmen. General Tire will hold 51 per cent of the stock in the Moroccan company. The rest will be divided between Moroccan and French investors. The General Tire investment is the first of a number foreign investments expected in the coming year, according to the Economy Minister. He said that among the advantages of the deal to Morocco was a saving of foreign exchange. Morocco now imports 300,000 tires a year from the United States and France. The initial production of the new tire plant is expected to cover half the country's needs and Moroccan officials hope the ultimate output will permit tires to be exported to other African countries.

To Produce Urethane Foam

► Scott Paper Co., Chester, Penna., has announced plans to enter the chemical field with the production of "Scottfoam", a new urethane foam for insulation, cushioning, filtration and other household and industrial uses. The first use of the material, the company disclosed will be in the apparel field. Brand & Oppenheimer, converter in the garment industry, plans to use Scottfoam as a part of its "Fahrenheit" brand of interlinings for outerwear garments. Scott said that the new foam, on which the company has patents pending, is available in several types. It will be produced in a wide range of pore sizes, densities and degrees of flexibility and rigidity.

Esso Research Moves Offices

► Esso Research and Engineering Co. has moved its executive offices from New York City to Linden, N. J. The move, involving 30 top executives and administrative personnel, will complete the company's headquarters move to its main site, the 56-acre Esso Research Center. Some 40 other headquarters employees moved to New Jersey earlier this year from the firm's New York offices at 15 West 51st Street. The research firm, central scientific affiliate of Standard Oil Co. (N. J.), employs about 3,000 persons.

William H. MacKay

Named Dunlop Vice-President

► William H. MacKay has been appointed vice-president of industrial and public relations and secretary of the Dunlop Tire and Rubber Corp., Buffalo, N. Y. As corporate secretary and director of public relations, Mr. MacKay succeeds John F. McCann, who has retired due to ill health. Mr. MacKay, formerly manager of industrial relations and industrial engineering, has been with Dunlop 30 years. For the past four years, he has also been occupied in reorganizing manufacturing operations under a modernization program undertaken by the firm. A native of Penn Yan, N. Y., Mr. MacKay is a graduate of Dartmouth College and was formerly a lecturer on personnel management at the University of Buffalo evening school. He is a member of the Buffalo Chamber of Commerce Industrial Relations Committee and the Manufacturing and Industrial Engineering Committees of the Rubber Manufacturers Association, Inc.

Bender Named Carwin Vice-President

► The board of directors of the Carwin Co., North Haven, Conn., has elected Donald A. Bender as vice-president. Mr. Bender, whose duties will include responsibility for the operations of the company's Chemical Division, will also continue as corporate secretary. Mr. Bender holds a B. S. degree in chemical engineering from Lehigh University and a master's degree from Columbia University. He joined Carwin in 1950. Previously, he had been associated with E. I. du Pont de Nemours & Co. and Allied Chemical and Dye Corp.

Butadiene Sent To Italy

► Goodrich-Gulf Chemical, Inc., Cleveland, Ohio, has announced that the first of several overseas shipments of American-made butadiene has been sent by barge from Port Neches, Texas, to Ravenna, Italy. The 2,200 ton cargo, an experiment in long distance transportation by barge, was expected to require 35 days to reach its destination.

New Goodyear Retread Plant

► Goodyear Tire & Rubber Co., Akron, Ohio, has announced that a new plant for the repair and retreading of giant off-the-road tires will be constructed in Sacramento, Calif. Scheduled to open April 1, 1958, the new plant will be built at a cost of approximately one half million dollars. It is expected to become an important link in Goodyear's retread and repair field activities, which have been expanded to meet the growing needs of contractors working on highway, mining and logging projects, and construction programs such as airports and dams. Considered to be one of the most modern and completely equipped retread plants of its kind in the industry, the new plant has facilities to retread off-the-road tires ranging in sizes from 11.00 x 24 to giant 29.5 x 29. The plant will also house 10 curing bands for top-capping the big off-the-road tires. The modernistic one-story building, made of reinforced concrete walls, is 246 feet long and 122 feet wide and embraces a floor area of more than 30,000 square feet. In addition to the shop area, the building will house general offices, plant manager's office, cement room, buffing facilities, drying unit, boiler room and shower and locker facilities. The Sacramento plant is the seventh in the company's chain of retread and repair plants located strategically throughout the nation to assure complete all-around tire service for Goodyear dealers, stores and other customers.

Establishes New Safety Record

► The footwear and general products plant of the U. S. Rubber Co., located in Mishawaka, Ind., is said to have set a new world's safety record for all manufacturing plants in the rubber industry. The plant has operated accident-free since November 28, 1956 and is still continuing to add hours to the record. The former record was 10,250,040 man-hours without a lost time accident or disabling injury. The Indiana plant had also set a previous safety record. In 1955, the National Safety Council presented the plant with an award for establishing a record as the safest footwear plant in the rubber industry. The former holder of the safety record for the entire rubber industry was the U. S. Rubber footwear plant in Naugatuck, Conn. That plant established the record, now broken by the Indiana plant, in 1956.

Olefins Division Names Officers

► Union Carbide Olefins Co., a division of Union Carbide Corp., New York, N. Y., has announced the appointment of officers, including H. D. Kinsey, president; R. N. Graham, executive vice-president; W. F. Reich, Jr., executive vice-president; N. C. Babcock, vice-president—marketing; L. J. Bowditch, vice-president—engineering; G. T. Felbeck, vice-president—research; E. P. Shetter, vice-president — production. The newly formed Olefins Company will handle the production and sale of the corporation's hydrocarbon products, including ethylene, propylene and butadiene.

Names in the News

Lester C. Winslow has been appointed assistant general sales manager of Clevite Harris Products, Inc., and will be succeeded as Detroit district sales manager by **George A. Grossman,** former manager of the company's Special Products Division.

R. Wesley Fish, formerly sales and service engineer in the Machinery Division, has been named sales and service engineer in the Roll Division for the United Engineering and Foundry Co.

Robert C. DeLollis has been appointed sales representative for the Mid-Atlantic sales territory of Emery Industries, Inc., succeeding **P. M. Leech,** who has been transferred to Emery's Chicago office.

Howard Lee Young, vice-president of American Zinc, Lead and Smelting Co., has been elected to the board of directors to fill the vacancy caused by the recent death of Erle V. Daveler, who was a director and vice-president.

S. T. Rose has been named group sales manager and **H. L. Hollingsworth** staff engineer in the Plastics Wire and Cable, Instruments and Foundry Group for the Electric Auto-Lite Co.

Stephen P. DeMallie, who was formerly with Celanese Corp. of America in sales and sales development capacities, has been appointed technical assistant to the president of Callaway Mills, Inc.

Charles A. Dana, associated with the Shoe Products Division of the Goodyear Tire and Rubber Co. since 1938, has been appointed to the newly created position of sales coordinator for the division.

David Robins has been elected a director of Hewitt-Robins, Inc., succeeding his father, the late Thomas Robins, Sr.

Guilford G. Johnson, who has headed advertising activities of the Wooster Rubber Co. for the last nine years, has been named general merchandising manager for the company.

Paul J. Pamer, previously associated with Goodyear production and the U. S. Army Signal Corps., has joined the Akron sales office of the Columbian Carbon Co.

Kenneth R. Peattie, who has been associated with the company since 1929, has been elected vice-president in charge of procurement for the American Felt Co.

Theodore W. Hummel, who joined the company in 1956 as a sales trainee in the Plastic Materials Sales Department, has been appointed a plastic materials sales representative for the B. F. Goodrich Co.

G. Herbert Metzger, formerly a supervising engineer, has been appointed manager of project engineering for the B. F. Goodrich Chemical Co.

Norman P. Phillips, who has been associated with the General Tire & Rubber Co. since May, 1956, has been promoted to manager of sales development for the company's Chemical Division.

Clifford Oman, formerly process superintendent for National Petro-Chemicals Corp., has been named assistant plant manager at Tuscola, Ill., for the company.

Professor Arthur V. Tobolsky, of the Frick Chemical Laboratory at Princeton University, has been elected chairman for 1958 of the Polymer Chemistry Division of the American Chemical Society.

Chester H. Peterson, president of the U. S. Rubber Reclaiming Co., Inc., is serving as a district governor of Rotary International, world-wide service organization, for the 1957-58 fiscal year.

Theodore P. Malinowski, formerly development manager, has been promoted to assistant director of product development for the Chemicals Division of the Atlas Powder Co.

James B. Clarke, who has been associated with the Chicago sales branch of the company since 1930, has been appointed sales representative for the National Aniline Division of Allied Chemical & Dye Corp. at Portland, Ore.

Charles H. Slater has been named marketing manager and **Warren F. Schumacher,** general sales manager for the J. T. Baker Chemical Co.

Lewis M. Ludlow has been promoted to special technical representative for market development in the M. A. Division of Wyandotte Chemicals Corp., while **John A. Bucher,** has been named to succeed Mr. Ludlow as sales representative on the West Coast.

Dr. William P. Utermohlen, Jr., previously assistant research director of the Toni Division for the Gillette Co., has been appointed director of research for the Versicol Chemical Corp.

Robert B. Warren, general manager of the Industrial Products Division for the Goodyear Tire & Rubber Co., has been honored at an executive luncheon after completing 30 years of continuous service with the company.

Arthur N. Stuart, formerly Detroit district manager, has been named sales manager of the Manufacturers Sales Department for the Firestone Tire & Rubber Co.

Harold H. Helm, chairman of the Chemical Corn Exchange Bank and a director of the 14 corporations, and **Malcolm P. Ferguson,** who is president of the Bendix Aviation Corp. and associated with several other organizations, have been elected directors of the U. S. Rubber Co.

Byron J. Anderson, formerly assistant chief technologist at the Tuscola, Ill., plant of National Petro-Chemicals Corp., has been named manager of a new polyethylene plant to be built by the company in Houston, Texas.

Harold E. Bechtold, Jr., previously product engineer for the B. F. Goodrich Chemical Co., has been named plastic materials sales representative and will also represent the general Chemicals Sales Department in the west coast area.

Joseph H. Kiernan has been promoted from Placco sales representative to product manager of Placco-brand building material products for the Borden Co.

John F. Davis, who has been associated with the company since 1949, has been named technical director for the Arizona Chemical Co.

Robert F. Gosselin, formerly administrative assistant, has been appointed purchasing agent for National Polychemicals, Inc.

Dr. R. P. Dinsmore, vice-president in charge of research and development for the Goodyear Tire & Rubber Co. received the 1957 Chemical Engineering Achievement Award at the 26th Exposition of the Chemical Industries, for pioneering application of chemical engineering principles and processes in extractive metallurgy of the atomic age metals.

William H. Davis, previously director of sales development, has been named chemical sales manager for the Petro-Tex Chemical Corp.

Charles N. Kimberlin, Jr., assistant director of the Esso Research Laboratories, has been presented with the Southern Chemist Award for his "outstanding career in the fields of catalysis and petroleum chemistry".

C. E. Little, president of the Servus Rubber Co., has been presented with a 25 year pin and a watch in commemoration of his 25th anniversary with the company.

Nicholas C. Gangemi, assistant director of research since 1955, has been appointed director of research for Pennsylvania Industrial Chemical Corp.

Marcus Rothschild, of M. Rothschild & Co., Inc., has been appointed chairman, while **Dr. Wallace E. Cake,** of the U. S. Rubber Co., has been named vice-president and co-chairman of the Rubber Division for the 1958 National Foundation for Infantile Paralysis Campaign.

Forms Instruments Firm

► Instruments for Industry and Research, a new firm located in Cheltenham, Penna., has been formed to produce low-cost automatic mechanisms to perform routine procedures for scientific research. Headed by Daniel R. Conlon, the firm has established research and production facilities in a 2,000 square foot laboratory building where three types of automated instruments are now in production and prototypes of other mechanized equipment are being tested. The instruments are small, low-cost, light-weight, electronic units designed to watch time, pressure, temperature, foam level, liquid level and other variables which now have to be watched closely for long periods of time. They automatically turn on and off other devices which perform mechanical operations such as cooling or heating a chemical reaction. Auxiliary devices are provided to detect potential failure in associated equipment.

Mr. Conlon, consulting engineer in instrumentation and former research automation specialist for Rohm & Haas Co., states that the new company hopes to increase the efficiency of the research worker by supplementing manpower with mechanical, electrical and pneumatic power. "For this reason we abbreviate our firm name to the tradename "FR", which is the engineer's symbol for power", Mr. Conlon says. A graduate of Union College in 1935, Mr. Conlon spent ten years with Atlantic Refining Co. in Philadelphia and Texas developing instruments for the production and refining of petroleum. For the past twelve years, he has done instrument research and development for Rohm & Haas in Philadelphia and Texas.

Naugatuck Promotes Tuley

► Dr. W. F. Tuley, who formerly supervised rubber chemical and synthetic rubber research, has been appointed group manager of chemical development, a newly created post, for the Naugatuck Chemical Division of the U. S. Rubber Co. Dr. Tuley has a bachelor's and a master's degree in chemical engineering from Oregon State College and he obtained his doctorate degree from the University of Illinois. He joined U. S. Rubber as a chemist in the company's general laboratories in 1928. In 1934, he transferred to the Chemical Division to work on rubber chemicals. Dr. Tuley has held several supervisory positions in the Division's Sales Production and Research Departments.

Schier Named ASME Secretary

► O. B. Schier, II, has been appointed secretary of the American Society of Mechanical Engineers. Mr. Schier, who was designated secretary-elect last June, succeeds Clarence E. Davies who was secretary of ASME for 23 years. Mr. Schier has been a member of the Society since 1932 and a member of the ASME staff for the past 11 years. He was elected assistant secretary in 1953 and named deputy secretary in December, 1956. A graduate of Lehigh University, he holds Mechanical Engineering and Master's degrees from that institution.

Jack Arnold, Jr.

To Manage Enjay Boston Office

► Jack Arnold, Jr., formerly a sales representative in New England, has been named manager of the Boston office of the Enjay Co., Inc., New York, N. Y. Mr. Arnold attended Rice Institute and received a degree in chemical engineering in 1948. He then became associated with the New Jersey Sales Division of Esso Standard Oil, working most of the time as an industrial sales representative. In June, 1955, he joined Enjay as a sales representative. In his new capacity, he will be responsible for Enjay's sales and other activities in the New England area.

Reorganizes Sales Force

► Paisley Products, Inc., Division of Morningstar, Nicol, Inc., New York, N. Y., has announced the reorganization of eastern Paisley sales management personnel to integrate the sales staff of the Federal Adhesives Corp., a recent acquisition. The following have been appointed: Philip M. Liner, eastern sales manager; H. R. Callahan, administrative sales manager; Arthur Mayer, manager of the Special Products Department; Mortimer E. Stern, director of technical market development; Edward Bearman, manager of the Adhesive Development Laboratory. I. G. Nichol, Paisley's assistant sales manager, will directly supervise the combined New York metropolitan area sales force. Samuel Tisser has been appointed manager of the Latex and Plastisol Department. Harold Stone retains his post as manager of the Adex Manufacturing Division in Baltimore, Md., which will now produce the Paisley Adhesive line in addition to its existing product line.

Dixon Named Carlisle President

► George F. Dixon, Jr., has been elected president of the Carlisle Corp., Carlisle, Penna., succeeding the late Furber I. Marshall. Mr. Dixon will continue as president of the Dart Truck Co., Kansas City, Mo., a wholly owned subsidiary of Carlisle, which produces heavy-duty trucks and trailers for off-highway use.

Eastman Staff Reorganization

► Eastman Chemical Products, Inc., Kingsport, Tenn., has announced several executive appointments. Spencer E. Palmer, a vice-president, has been named first vice-president. R. S. Leonard, formerly comptroller, has been appointed assistant vice-president and R. L. Flanary, previously assistant comptroller, has been named comptroller. Dr. James E. Magoffin and David C. Williams have been elected vice-presidents. At the same time, Henry L. Ford has been elected a vice-president and W. Chamberlain Hale an assistant vice-president of Tennessee Eastman Co., the Kingsport, Tenn., division of Eastman Kodak Co., Rochester, N. Y.

In additional changes in the Eastman Chemical Products organization, John P. Tokarz, now assistant to the first vice-president of Tennessee Eastman, has been named assistant to the first vice-president of Eastman Chemical Products. E. C. Cathcart has been appointed sales manager of the Plastics Division succeeding Mr. Williams. W. P. Bussart, formerly in charge of the St. Louis office, has been transferred to Kingsport as assistant sales manager in this division. Guy A. Kirton, assistant sales manager for the Chemicals Division, has been appointed sales manager, succeeding Dr. Magoffin.

Seiberling Sales Realignment

► Seiberling Rubber Co., Akron, Ohio, has announced a top management shift in the Sales Department in order to give special attention to new tire markets. Walter T. Johnson has been named assistant vice-president in charge of sales, a newly created position, in which he will build tire distribution in new markets. Jack A. Fouché has been appointed sales manager to succeed Mr. Johnson and Orrin K. Feikert, former truck tire sales manager, succeeds Mr. Fouché as assistant sales manager. Mr. Johnson has been with Seiberling almost 31 years. He was manager of the company's Atlanta and Boston sales districts before he became assistant sales manager and then sales manager. Mr. Fouché, assistant sales manager for four years, started in diversified products, where he later became assistant department manager and then manager. He has also been manager of advertising and merchandising. Mr. Feikert has served in the company's Development and Service Departments and the former Commercial Sales Department. He has been a truck tire engineer and has managed the Accessories and Repair Materials Department.

Named Cabot Representative

► Godfrey L. Cabot, Inc., Boston, Mass., has announced the appointment of William Campaigne to the company's Pampa, Texas, office as southwestern technical service representative. Mr. Campaigne received a B. S. degree in chemical engineering in 1937 from the University of Minnesota. Before he joined the Cabot organization, he was associated with the Goodyear Tire & Rubber Co. in the Industrial Products Division.

West Coast News

► Tlargi held its 20th consecutive annual Christmas Party on Friday, December 13 at the Pacific and Siera Rooms in the Hotel Statler in Los Angeles, Calif. A social hour was held from 6:30 to 7:30 p.m., and dinner was served at 7:30 p.m. Highlights of the party were entertainment, dancing, dinner music and the distribution of ladies' favors. The Christmas Party Committee consisted of Charles Kuhn, *Chairman;* Bert Biheller, John Dum, Howard Erwin, Thurman Graves, A. J. Hawkins, Tom Keenan, Joe Larkin, Elden Sallee and Robert Scherner.

The group has elected the following officers and board directors: *Chairman,* A. H. Federico (C. P. Hall); *Associate Chairman,* Charles Kuhn (Master Processing); *Vice-Chairman,* B. R. Snyder (R. T. Vanderbilt); *Secretary,* L. M. Chaffee (Ohio Rubber); *Treasurer,* W. M. Anderson (Gross Manufacturing). Directors elected for two years were: Howard Fisher (W. J. Voit Rubber); William Haney (Kirkhill Rubber); John Ryan (Shell Chemical). Those elected for a one year term were: Walter Boswell (Thiokol); Milton Churchill (Naugatuck Chemical); C. E. Huxley (Enjay), and R. N. Phelan (Atlas Sponge Rubber).

The organization has also announced the selection of the Year Book Committee for 1958. The committee consists of the following: C. M. Churchill, *Chairman;* A. D. Abshire, T. E. Corcoran, A. J. Falkenberg, Ray Perkins, F. L. Price, J. J. Stetina and R. A. Stringfield. Consultant for the committee will be H. W. Sears. The committee is responsible for the gathering of all the necessary material, editing and laying out the year book. This is considered to be one of the biggest jobs in the Tlargi organization.

► Furane Plastics, Inc., Los Angeles, Calif., has announced several appointments in the laboratory and in plastics sales activities. Neil P. Gedda, formerly with National Starch Products, San Francisco, has been assigned to technical sales of the Building Trades Division. Arthur N. Heath, who was previously chief chemist at Electrofilm Inc., North Hollywood, has been named to serve in technical sales for the Electrical Division. Albert S. Johnson, a recent graduate of the University of Southern California, has been appointed laboratory technician. Masuo Toji, a graduate of organic chemistry at the University of California, has been named to serve in the laboratory as a research chemist. Irving Azaren, formerly with A. Eddy Goldfarb and Associates, North Hollywood, and a graduate of the chemistry division of the University of Illinois, has been appointed research technician in Furane's laboratory.

► Norman Grant, former truck tire representative for the Los Angeles district of the Goodyear Tire & Rubber Co., Akron, Ohio, has been appointed petroleum account representative for the firm's western region. Mr. Grant joined Goodyear in 1937 at the firm's Huntington Park, Calif., store where he served successively as general service man, service manager and budget salesman. Later assignments included managerial posts in Los Angeles, Alhambra and Glendale stores. After Navy service in World War II, Mr. Grant resumed his position as manager of the Glendale store and remained there until 1950, when he was appointed general line salesman in the Los Angeles district. He was appointed truck tire representative in 1953.

► Jay E. Miller has been named western director of public relations for the B. F. Goodrich Co., Akron, Ohio, succeeding James McCready, who is now returning to the company's public relations staff in Akron. Headquarters will be located at the company's Los Angeles plant. Mr. Miller, who has been on special assignment at Akron for the past year, was formerly western public relations manager. In June, 1956, he was named manager of the B. F. Goodrich Speakers's Bureau and organized a company-wide speaking program which is now in operation in the United States and Canada. He joined the company in 1936 and was advertising manager of several divisions before his assignment to the western public relations post in 1949.

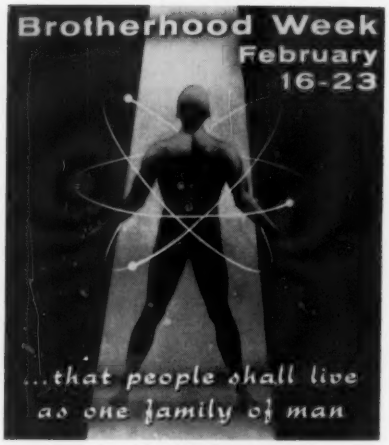
► L. A. Standard Rubber Co., Los Angeles, Calif., has announced that the company's Purchasing and Sales Departments have been moved to Plant #3, which is located at 1566 E. Slauson Ave., Los Angeles. The telephone number is Ludlow 3-2780 and 3-2079.

► California Rubber Products, Inc., has moved its general offices and the Duct and Rubber Divisions to 1754 S. Crenshaw Blvd., Torrance, Calif. The new phone number is Fairfax 8-2301.

► Richard J. Bonin, Jr., formerly director of one of the country's largest distributors of swim sports equipment, has been named sales manager for Swimaster, an affiliate of Pacific Moulded Products Co., Los Angeles, Calif.

► Neil Pestal has been promoted to chief chemist at the Firestone Tire and Rubber Co., succeeding R. L. Hutchins, who retired on November 1, 1957.

► Conforming Matrix Corp., Toledo, Ohio, has appointed Milton T. Schimmel as West Coast sales engineer, with offices at 14017 S. Wilkie Ave., Gardena, Calif. Mr. Schimmel, formerly special consultant to the spray decorating field, has wide experience in production spray painting. From 1948 to 1956, he was associated with Conforming Matrix as engineer and general manager



Phillips Chemical Promotions

► Phillips Chemical Co. has announced four promotions to newly created positions in the Plastics Sales Division. W. R. Clark has been named sales manager; W. H. Guthrie, manager of sales promotion; R. M. Wallace, sales coordinator and D. S. Sherwin, manager of marketing research. R. V. Jones continues as manager of technical service and development. The Plastics Sales Division is headed by George Wash, who previously also acted as sales manager. Mr. Clark joined the Market Development Division of the Phillips Research and Development Department in 1953 as a senior sales engineer and transferred to the chemical firm's Plastics and Sales Division in July, 1955, as assistant sales manager. Mr. Guthrie became associated with the parent company, Phillips Petroleum Co., in 1938 in Philgas sales and transportation operations. He transferred to the sales promotion section in 1951 and became assistant manager in 1955. Mr. Wallace joined Phillips Gasoline Department in 1930 and transferred to the Plastics Sales Division in July 1955 as administrative assistant and coordinator. Mr. Sherwin started with Phillips in the Gasoline Department in 1942 and has served in various capacities in the company. Following three years of loan service to the Reconstruction Finance Corp., he became assistant coordinator of the chemical firm's Rubber Chemicals Division in 1955.

Installs Automatic Presses

► Firestone Tire & Rubber Co., Akron, Ohio, has installed thirteen automatic presses for curing large farm tractor tires at its Des Moines, Iowa, plant. The new curing line, consisting of 75-inch steam Bag-O-Matic presses, is said to speed up the curing process by eliminating one step in the manufacturing procedure. Bag-O-Matics for passenger car tires have been in use in company plants for several years. The larger presses are the first to be installed in the Des Moines tire plant. The company claims that their use eliminates the need for placing rubber curing bags in tires before vulcanization. The new presses are now in full production.

Consolidates Two Divisions

► Interchemical Corp., New York, N. Y., has announced the consolidation of the R-B-H Dispersions and Textile Colors Divisions into the new Color and Chemicals Division with headquarters in Hawthorne, N. J. William N. Davies, formerly division president of Textile Colors, will be general manager of the new unit. William J. Rothemich will be general production manager and Harold D. Craft, general sales manager. Mr. Rothemich has served as president of both divisions and most recently has been an Interchemical vice-president. Mr. Craft most recently served as head of the R-B-H Dispersions Division.

The Bound Brook factory will continue production of pigment dispersions under the R-B-H trademark for the coatings and plastics industries under the direction of William T. Hulse, while the sales organization for R-B-H products will remain under the direction of Richard L. Lynch, sales manager—coatings and plastics industries. Philip H. Ingham will continue to head the Bound Brook Laboratory as manager of development—dispersions for coatings and plastics. Albert Saunders will be manager of the newly established Commercial Development and Evaluation Department. Ludolph H. Conklin, Jr., will be assistant sales manager—coatings and plastic industries and will continue as manager of technical sales service.

The company believes that this merger will have the advantages of the technical personnel and facilities of the present units on an enlarged scale and will also be in a position to make more effective use of the wide variety of production facilities of the two divisions.

Expands Polyethylene Production

► A new medium density polyethylene has been announced by the Eastman Kodak Co., Rochester, N. Y. The new material is said to have greater stiffness, higher heat resistance and greater resistance to abrasion than low-density polyethylene. The capacity of the Texas-Eastman Division at Longview, Texas, will be increased more than 50 per cent to 85,000,000 pounds a year by the end of 1958, producing both medium and low-density products. The projected increase will be the third expansion since the plant began operations in October, 1954, when capacity was 20,000,000 pounds a year.

Buffalo Elects Officers

► Approximately 250 members and guests attended the Buffalo Rubber Group Annual Christmas Party on December 3 at the Town Casino in Buffalo, N. Y. The meeting featured the election of officers for 1958. They are: *Chairman,* John Helwic (Dunlop Tire); *Vice-Chairman,* Richard Herdlein (Hewitt-Robins), and *Secretary-Treasurer,* Lawrence Halpin (Dunlop Tire). Eugene Martin (Dunlop Tire) and Robert Prior (Hewitt-Robins) were elected to the executive committee. Festivities included cocktails, dinner, a floorshow and presentation of Christmas gifts.

Onslow B. Hager

Named Alco Vice-President

► Dr. Onslow B. Hager has been elected vice-president of the Alco Oil and Chemical Corp., Philadelphia, Penna. Dr. Hager has been director of research for the company since 1947 and for twelve years prior to that served as head of one or more textile laboratories of Rohm and Haas Co.

P. C. I. Builds 30 Mile Pipeline

► Contractors for Petroleum Chemicals, Inc., New Orleans, La., are completing what is said to be the first interstate pipeline to transport high purity ethylene, linking three companies in Lake Charles, La., and Orange, Texas. The pipeline extends from the Lake Charles manufacturing plant of Petroleum Chemicals to two contract customers in Orange: E. I. du Pont de Nemours & Co., Inc. and the Spencer Chemical Co. It is constructed of 6⅝ inch pipe and stretches 30 miles across Louisiana, crossing several navigable canals and bayous as well as the Sabine River. Ethylene will be placed in the pipeline at Lake Charles at a pressure of 1,000 pounds per square inch and delivered at the other end at 450 pounds per square inch. According to P. C. I., this will permit the line to serve as a storage facility as well as a means of delivery.

Elastomer Technology Course

► The New York Rubber Group course on Advanced Elastomer Technology, which begins on Tuesday, February 18, is still open to applicants. A fifteen lecture course, the first two lectures will be held on Tuesdays and the third and subsequent lectures on Mondays. They will be conducted at the Engineering Societies Building, 29 W. 39 St., New York, N. Y., from 7:30 to 9:45 p.m. Applications for registration were to have been mailed during January, with registration limited to the first 200 applicants. Non-members may obtain registration forms by contacting L. C. Komar, Titanium Pigment Corp., 99 Hudson St., New York 13, N. Y. The fee will be $25 for members of the New York Rubber Gorup and $28 for non-members.

Bonding Of Polyethylene

► Technical Reports News Letter, published monthly by the United States Department of Commerce, Office of Technical Services, Washington 25, D. C., summarizes *Bonding of Polyethylene,* by W. H. Scrader and M. J. Bodnar, Picatinny Arsenal, U. S. Army Ordnance Corp. The 39 page volume describes recent U. S. Army Ordnance tests which are said to have demonstrated that the normally poor adhesive bonding properties of polyethylene can be improved by treatment with concentrated chromic acid. This process alters the surface of polyethylene so that good peel and shear strength are possible and it is recommended prior to bonding whenever high strength bonds are required. Report PB 131099 states that a series of commercial and experimental adhesives for bonding polyethylene were also evaluated. Most showed relatively low bond strengths at both 73° and 160°F. and generally poor flexibility and adhesion at —65°F. A limited selection was recommended where high strength is not required. It was observed that bond strengths of currently available polyethylene adhesives depend primarily on their permanent tack tendencies rather than on chemical reaction or mechanical interlocking with the polyethylene. Test specimens for the peel tests consisted of polyethylene strips bonded to steel panels and two strips of polyethylene bonded together. The report was published in March, 1957, and is priced at $1.00.

Molded Rubber & Plastic Moves

► Molded Rubber & Plastic Corp. held open house on December 6 to celebrate the company's removal to new quarters at 106 E. Melvina St., Milwaukee, Wisc. The new plant has about 15,000 square feet of working area, including a tool and die shop. The company, successor to Non-Breakable Button Corp. which was founded in 1921, expanded its product line during World War II and now makes a variety of natural and synthetic rubber items.

New Titanium Dioxide Capacity

► The Chemicals-Pigments-Metals Division of the Glidden Co., Baltimore, Md., has announced the completion of construction of a second production unit for the manufacture of titanium dioxide at its Adrian Joyce Works. A third production unit is scheduled to go on stream early in the summer of 1958. The added production units, the company states, will assure customers of an adequate supply of Zopaque of the highest quality.

Blackstead Elected Vice-President

► Sun Chemical Co., Long Island City, N. Y., has announced the election of Eric N. Blackstead as a vice-president and general manager of the company's chemicals group. Mr. Blackstead was president and general manager of the Ansbacher Siegel Corp., a pigment producer recently acquired by Sun.

Canadian News

► Du Pont Co. of Canada (1956) Ltd., Montreal, Que., has announced the renewal of its program of financial aid to help improve science teaching in Canada's secondary schools for the 1958-1959 academic year. The program, which began in 1956, provides for 15 annual grants of $1,700 each. A grant may be used as a $1,500 scholarship in teacher training for a prospective science teacher; as a $1,500 scholarship for a secondary school science teacher whose ability to teach science would be improved by a year's postgraduate study, or in the form of three summer scholarships of $500 each to give secondary school teachers additional training in science. In each case, $200 of the total grant is awarded the university for administration costs. Selection of the candidates and administration of the grants is left to the discretion of the universities through the department or faculty of teacher training. Except for the summer scholarships, if the teacher is a married man, the value of the scholarship is increased by $600. The ten universities participating are Dalhousie, University of New Brunswick, Laval, Université de Montréal, University of Toronto, University of Manitoba, University of Saskatchewan, University of Alberta, and University of British Columbia.

► General Tire & Rubber Co., of Canada, Ltd., Welland, Ont., has officially changed its name to Industrial Products Division. Known as the Stokes Division since 1950, when the Stokes Rubber Co. was acquired by General Tire & Rubber, the Welland operations have been expanded into major suppliers of the automotive, refrigeration, appliance and communications industries of Canada. It is believed that the new name defines more accurately the type of operation which takes place at Welland. The firm has extensive manufacturing in custom designed, molded and extruded rubber, molded and extruded plastic components and service for precision tooling. The unit has been affiliated with the Industrial Products Division of the parent company, General Tire & Rubber Co., Akron, Ohio.

► M. L. Snyder & Son has announced the removal of its Canadian factory from Toronto, Ont., to Woodbridge, Ont., which is located about 25 miles north of Toronto. An addition was built at the Woodbridge facility which is said to more than triple its size. The Toronto equipment and many of the personnel were transferred to the new building. All of the company's Canadian manufacturing will be centered at Woodbridge, which will make all eastern shipments. In nearly all cases, shipments to the west coast will be made from the company's branch at Vancouver, B. C.

► Imperial Paper and Color Corp. (Canada) Ltd., has announced that it has agreed to purchase the dry color manufacturing facilities of the Sherwin-Williams Co. of Canada, Ltd. The agreement includes the purchase of good will, customer lists and manufacturing procedures for dry colors, but does not include any of Sherwin-Williams' other activities. Sherwin-Williams will discontinue all dry color operations and Imperial will move the equipment it has purchased to the new St. Johns, Que., color plant.

► E. V. Larson Co., Ltd., Toronto, Ont., has been appointed Canadian sales representative for Davis-Standard, Division of Franklin Research Corp., Mystic, Conn. Larson will cover all of Canada, handling the entire line of Davis-Standard thermoplastic and rubber extruders and wire insulating machinery. The company states that the appointment of this Canadian sales representative will provide faster, more efficient servicing of the Canadian market.

► Miner Rubber Co., Ltd., Granby, Que., and Peters Manufacturing Co., Wollaston, Mass., have announced an agreement whereby Miner will make all types of cable tape for the wire and cable industry of Canada. Peters, founded in 1898 and said to be a leader in the tape industry in the United States, will supply the technical service.

► A new rubber manufacturing plant is being built on a two acre site in South Edmonton, Canada, by the Continental Rubber Co., Ltd. Involving an investment of between $200,000 and $250,000, the plant is said to be the first molded and extruded goods plant in Alberta. The major unit to be installed is a rubber mill. Installation of some equipment already has been completed and opening of the plant is expected in the early spring. One of the unit's operations will be the production of rubber for lining of tanks, pipe fittings and valves. Natural rubber and synthetic rubber from a Polymer Corp. plant in Sarina, Ont., will be used. The facility is an L-shaped building 100 by 120 feet. It will employ from 10 to 20 persons at the start and perhaps 50 persons later.

► L. A. Young Spring & Wire Corp., Detroit, Mich., has acquired the assets of Canadian Automotive Trim, Ltd., Ajax, Ont., for an undisclosed amount of cash. The Canadian concern is a subsidiary of National Automotive Fibres, Inc., Detroit, Mich. The firm employs 250 persons in the production of automotive trim, seat padding and seat covers for the Canadian automotive industry. The plant has 120,000 square feet of floor space. According to N. E. Ely, president of Young, the Ajax unit will be operated as the Canadian Automotive Trim Division of L. A. Young Industries of Canada, Ltd., a wholly-owned subsidiary.

Phillips Plant Managers Named

► Phillips Chemical Co. has announced the appointment of G. H. Short as manager of the Plains butadiene plant near Borger, Texas. C. W. Forman will manage the adjacent Plains copolymer plant. H. D. Trotter has been transferred from Borger to the Cactus plant near Dumas, Texas, where the company operates facilities for ammonia, ammonium, nitrate and nitric acid. Mr. Short, who graduated from the University of Texas with B.A. and M.A. degrees in chemistry, started in the Phillips Research and Development Department in 1935. He became assistant superintendent at the Plains Plant in 1952 and was named plant manager in 1955. The two Plains facilities, which in the future will be operated as separate plants, recently underwent extensive expansion. Mr. Forman received his B.S. degree in chemical engineering from Texas A & M College and started at the company's Borger refinery in 1937. He was named assistant superintendent at the Cactus plant in 1951 and a year later became superintendent. Mr. Trotter studied mechanical engineering at the University of Kansas and joined the Phillips Kansas City Refinery in 1939. He became mechanical superintendent there in 1954, then transferred to Phillips Chemical in 1955 as assistant superintendent at the Plains plant.

Goodrich Director Retires

► Alfred B. Jones, a member of the B. F. Goodrich board of directors for more than 25 years has retired. Mr. Jones became associated with the rubber industry in 1908, when he became superintendent of the South Akron plant for the Diamond Rubber Co. In 1916, he was elected a Goodrich director, and he became a member of the executive committee in 1917. Mr. Jones was named vice-president in charge of plant administration in 1918 and the following year made an eight month world tour for the company during which he studied the factors affecting the rubber industry. He left Goodrich in 1921, but rejoined the board of directors in 1937. In addition to business interests, Mr. Jones has contributed much time to civic activities. During World War I, he was deputy commissioner and later commissioner of the Red Cross for France. From 1936 to 1946, Mr. Jones was chairman of the New York City Tunnel Authority. A native of Mt. Holly, N. J., he received his chemical engineering degree from Princeton University in 1896.

Suburbanite Nylon Bicycle Tire

► The first bicycle tire constructed entirely of nylon cord has been placed on the market by the Goodyear Tire & Rubber Co., Akron, Ohio. Called the "Suburbanite 175 Nylon", the tire features a stronger, more resilient carcass than conventional bicycle tires, the company states. It has open lug design, self cleaning cleats and bladed riding ribs to give firm traction in snow, sand, mud and icy or wet surfaces. The new tire is available in size 26 x 1.75, blackwall.

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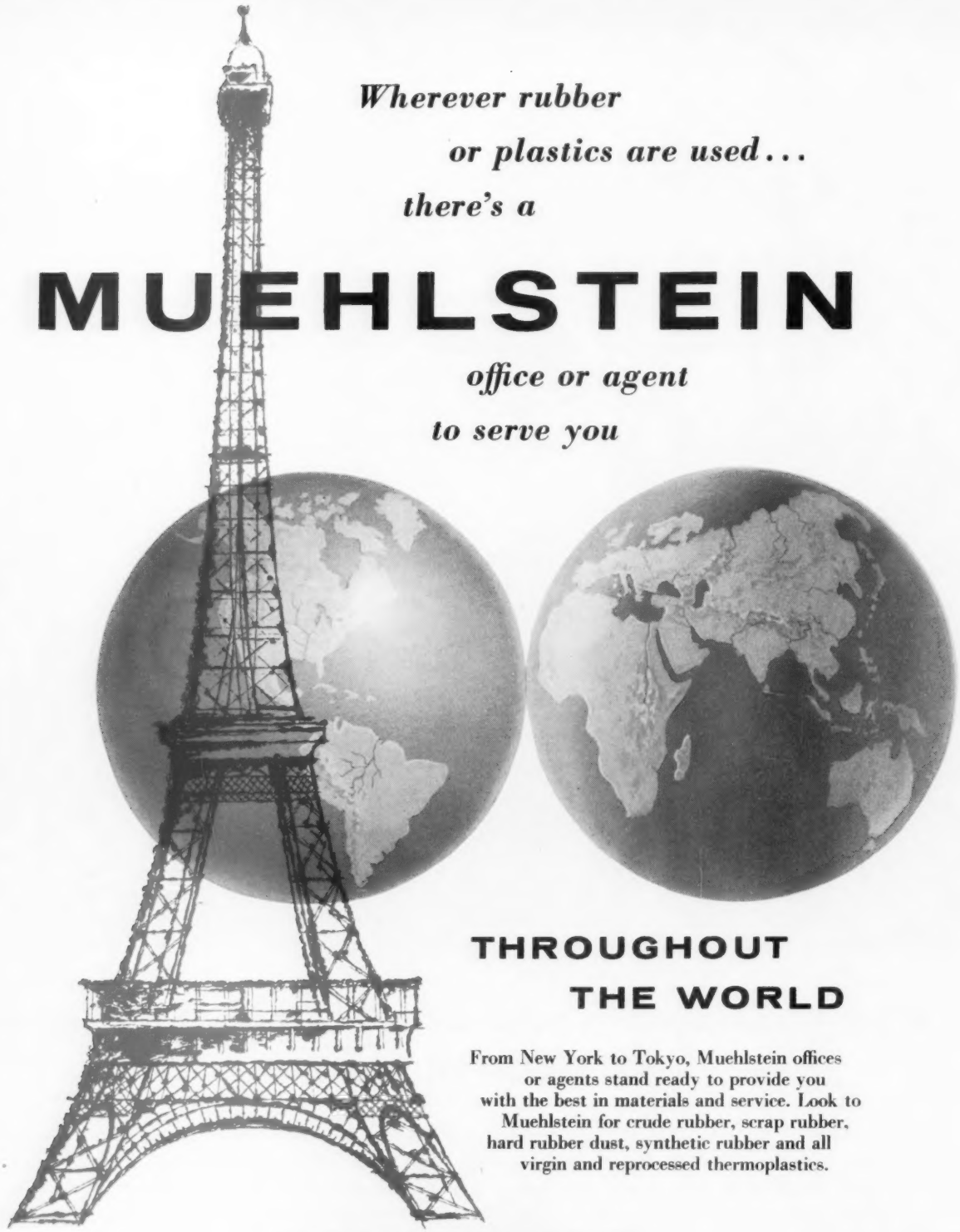

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RTV Silicone Rubber Compounds

► A wide range of applications in the aircraft, electrical and electronic, construction, dental and other industries can be made with two new room temperature vulcanizing (RTV) silicone rubber compounds now available from the Silicone Products Department of the General Electric Co. Although requiring no special curing equipment or long curing times, compounds "81712" and "81726" offer many of the unique physical and electrical properties normally associated with silicone rubber, the company states. Both 81712 and 81726 are available in commercial quantities. Among the uses for these compounds are encapsulation of electric and electronic components; sealing, and filling voids; protecting parts against vibration and moisture; repairing or replacing rubber gaskets and seals; caulking and glazing; and model making. A red compound, 81712 has extremely low shrinkage. It is suggested for model making, sealing, and other uses where accuracy and dimensional stability are important. RTV compound 81726, a beige material, is harder and tougher than 81712 but not as elastic. It shrinks about 2 per cent during cure, several times more than 81712.

Excellent ozone and weathering resistance, flame resistance, low temperature flexibility, and good performance at temperatures as high as 500°F. are common physical characteristics of these RTV compounds. In addition, both possess good electrical properties, General Electric officials declare. Another outstanding feature shared by 81712 and 81726 is ease of handling. Both offer good storage stability, uniform pot life, and consistent curing characteristics. Cure times may be varied from several minutes to 48 hours, and pot life from two minutes to six hours.

Philadelphia Fall Dance

► The Philadelphia Rubber Group held its Annual Fall Dance on November 22 at the Manufacturers Golf and Country Club, Oreland, Penna., with 240 members and guests attending. One of the special features of the dance was the awarding of approximately twenty draw prizes to the ladies attending. The committee in charge of arrangements for the dance consisted of: T. W. Elkin (R. T. Vanderbilt); R. B. Carroll (R. E. Carroll); A. L. Shaw (B. F. Goodrich), and A. J. DiMaggio (Firestone). The group has scheduled a panel discussion on "The Use of Textiles in the Rubber Industry", for January 24, at the Poor Richard Club in Philadelphia, Penna.

Chicago Group Hears Sears

► W. J. Sears, vice-president of the Rubber Manufacturers Association, was the speaker at the Chicago Rubber Group meeting held on November 15 at the Furniture Mart in Chicago, Ill. The topic of Mr. Sears' talk was "The RMA—An Industry Service Organization". Mr. Sears described the organizational structure of the R. M. A., giving a summary of its functions; by-laws; membership; constitution; divisions; committees and activities.

Financial News

Wooster Rubber

► For 1957: Net income of $1,061,306, which is equal to 90c per common share, compared with $1,366,533, or $1.16 a share, in the previous year. Net sales in 1957 totaled $21,100,472 compared with $19,674,957 last year. Earnings per share of common stock for 1956 were adjusted to reflect increase in the number of shares from 1,084,914 to 1,178,674 as a result of stock dividend on December 1, 1956, of one share for each twenty shares then outstanding.

Armstrong Rubber

► Year ended September 30: Net income of $2,950,423, which is equal to $1.90 per common share, compared with $2,797,963, or $1.60 per share, in the 1956 fiscal year. Sales in fiscal 1957 totaled $76,137,429, compared with $71,313,421 in the preceding year.

Sandura

► Nine months to September 30: Net income of $448,619, compared with $505,444 in the same period last year. Sales in the first nine months of 1957 totaled $8,600,115 compared with $5,966,169 in the 1956 nine month period.

Triangle Conduit

► Nine months to September 30: Net income of $2,641,729, which is equal to $1.95 a share, compared with $2,421,302, or $1.78 a share, in the corresponding period of the preceding year.

Rome Cable

► Six months to September 30: Net income of $703,000, which is equal to $1.26 a common share, compared with $1,181,000, or $2.23 a share in the same period last year.

Okonite

► Nine months ended September 30: Net loss of $96,820, compared with a net income of $1,208,209, which is equal to $6.24 a share, in the first nine months of 1956.

Cooper Tire

► Nine months to September 30: Net income of $295,247, which is equal to $1.15 a common share, compared with $362,303, or $1.41 a share in the 1956 nine month period.

Plastic Wire & Cable

► Year to September 28: Net income of $734,126, which is equal to $3.95 a share, compared with $636,632, or $3.80 a share, in the preceding fiscal year.

U.S. Rubber Consolidates Operations

► U. S. Rubber Co. announced that it is consolidating the operations of one of its oldest subsidiaries, the New York Belting and Packing Co., with the sales and distributing organization of its Mechanical Goods Division. The move is designed to strengthen the company's nationwide network of industrial rubber products distributors. All of the company's industrial rubber products will now be sold under U. S. Rubber brand names. This, according to Edward T. Day, general sales manager, will enable the company to strengthen and broaden its service to distributors as well as give them the advantage of far greater advertising and sales promotion.

New York Belting's sales and operating staff of approximately 100 persons will be integrated with U. S. Rubber's nationwide field sales organization. Joseph A. Conlon, formerly vice-president of New York Belting and Packing, will become marketing manager, transmission products. New York Belting and Packing was one of the oldest industrial rubber products manufacturers, having been founded in 1846 only seven years after the original vulcanization of rubber. It is said to have produced the first rubber covered transmission belt, the first rubber covered conveyor belt, the first wire braid steam hose, and the first rubber bonded grinding wheel. It became a part of U. S. Rubber in 1905.

Eastozone 32 Antiozonant

► Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., New York, N. Y., has announced the development of a third phenylenediamine type antiozonant, "Eastozone 32". According to the company, laboratory tests indicate that the new antiozonant is effective in from 1 to 2 parts per hundred of rubber, which is said to be ½ to 1/3 the amount required of other commercially available antiozonants. Identified as N,N'-Dimethyl-N,N' - di - (1 - methylpropyl) - p - phenylenediamine, the new product is a reddish brown liquid with a refractive index of 1.5320 at „80°F.; a specific gravity of 0.933 at 80°F.; a Saybolt Universal viscosity of 52 secs. at 100°F., and a Cleveland Open Cup Flash point of 333°F. It is insoluble in 10 per cent sodium hydroxide but miscible with benzene and ethyl alcohol. It is also soluble in water with a pH 3 to pH 10 and slightly soluble in water with a pH 12.

ASTM Yearbook Available

► The ASTM Year Book, published in September 1957, is now available from the American Society for Testing Materials, 1916 Race St., Philadelphia, Penna. A complete fact book covering the activities of ASTM, the volume contains lists of officers; a list of members; general information about the organization and information about ASTM technical committees, by-laws and its charter as well as the society's awards and lectures.

Obituaries

Paul I. Murrill

► Dr. Paul Ingold Murrill, former research director of the R. T. Vanderbilt Co., New York, N. Y., died on December 17 at his home in Norwalk, Conn. He was 82 years old. Born in Hickory, N. C., Dr. Murrill obtained a B.S. degree from the University of Kentucky in 1895. After a year of graduate work at that University, he continued his studies at Michigan and received a Ph. D. in 1899. Dr. Murrill served for a year as associate professor of chemistry at Alabama Polytech after which he held a number of industrial positions. These included work with the U. S. Department of Agriculture, E. I. du Pont de Nemours & Co. and the R. T. Vanderbilt Co. His active association with R. T. Vanderbilt began in 1920 and was terminated when he retired in 1940. During his industrial career, Dr. Murrill obtained 20 patents, a number of which were important contributions to the rubber industry in the field of vulcanizing agents, accelerators and vulcanization and antioxidants. Dr. Murrill was a member of the American Chemical Society, American Institute of Chemical Engineers and the Chemists' Club of New York City as well as of a number of social organizations.

Ervin A. Young

► Ervin A. Young, retired vice-president of the Ohio Injector Co., died on December 2 in Wadsworth Municipal Hospital after a lingering illness. He was 72 years old. Mr. Young, who was born near Clinton, Ohio, had lived in Wadsworth for 47 years. His father, the late Charles Young, was one of the founders of Ohio Injector in 1883. A graduate of Case Institute of Technology, Mr. Young joined Ohio Injector in 1922 as a lathe operator. He was placed in charge of machine and tool design and initiated the use of automatic machines in place of hand lathes. Mr. Young designed and was in charge of the company's new buildings in 1917 and was later made factory superintendent. He was factory manager from 1921 to 1934 and then became vice-president in charge of production.

D. T. Starr

► D. T. Starr, president and majority stockholder of the Gross Manufacturing Co., Inc., Monrovia, Calif., died on November 25, following a heart attack. Mr. Starr acquired Gross Manufacturing in 1937 from J. G. Gross, who founded the business in 1924 around the original patent for bevel cut tube repairs. Before he acquired Gross Manufacturing, Mr. Starr was associated for about 18 years with the Bowes "Seal Fast" Corp. as general field sales manager. Mr. Starr contributed many original product developments in the field of tire repairing and held several patents in this field.

Verna M. Greer

► Verna Mae Greer, retired cashier for the Firestone Tire & Rubber Co., Akron, Ohio, died on December 2 in City Hospital, Akron, Ohio, after an illness of 10 months. She was 75 years old. Miss Greer joined Firestone in 1904 as a stenographer. Six months later, she was promoted to sales stenographer and two months after that, she was appointed credit stenographer. After an interim of two years, she became assistant cashier and in 1908, she was named cashier, a title she kept until her retirement in 1954. Born in West Farmington, Ohio, Miss Greer moved to Akron with her parents when she was 11 years old. She attended old Akron High School and after she was graduated, she spent six months at Actual Business College. An active business woman, Miss Greer was internationally known. At her combination 50 year and retirement party, she was honored by members of the Firestone organization ranging from floor sweepers to top executives. She is survived by several neices and nephews.

Charles B. O'Connor

► Charles B. O'Connor, retired general sales manager of the Tire Division of the B. F. Goodrich Co., Akron, Ohio, died on November 23 at his home in Bryn Mawr, Penna. Born in Elmira, N. Y., Mr. O'Connor joined Goodrich in 1918 in New York after serving in the U. S. Tank Corps during World War I. He was given a brief training course and assigned to the Truck Sales Department of the New York Branch. Two years later, he was made branch manager in Newark, N. J. and in 1925, he was branch manager in Jacksonville, Fla. Later that year, he became manager of the Specialized Sales Division in Akron and was also manager of the Truck Tire Department. When Goodrich-Silvertown, Inc., was established in 1929, Mr. O'Connor was appointed vice-president and placed in charge of that organization. He was named general sales manager in 1930. Mr. O'Connor is survived by his wife, a daughter and three sons.

Granted Delay On Stock Plan Reply

► E. I. du Pont de Nemours & Co., Wilmington, Del., has been granted a delay on the date for its reply to a government plan for divestiture of its General Motors Corp. stock. DuPont's answer was due on December 24, but Federal Judge Walter J. LaBuy granted a delay until after the Internal Revenue Service gives a ruling on the tax consequences. The ruling is expected within the next few weeks. DuPont owns about 23 per cent of the stock of General Motors and the Supreme Court has ruled that this constitutes a violation of anti-trust laws.

Two Firestone Tire Plants Completed

► Firestone Tire & Rubber Co., Akron, Ohio, has announced that production has begun in two new plants located in Havana, Cuba, and Manila, Philippine Islands. The new facilities are part of an over-all expansion, construction and modernization program. The Havana plant will produce passenger, truck and off-the-highway tires for Havana's growing motor vehicle population. A skeleton force of technicians and supervisors from Akron are directing initial operations. R. L. Raines has been appointed managing director of the Cuban plant, H. H. McCallister, factory manager and W. G. Chester, production manager.

The Manila plant is the first Firestone facility to be put into operation in the Far East. It will supply passenger and truck tires for Philippine automobile assembly plants and replacement tires for retail outlets in the Philippines. Much of the raw materials used in the manufacture of tires in Manila will be purchased locally. A 1,000 acre natural rubber plantation is being prepared near the new plant to supply raw materials for tires manufactured there. J. N. Vaughan has been named managing director of the Manila plant, W. R. Emig, factory manager and R. D. High, production manager. The tire plants are Firestone's 13th and 14th to be located outside the United States.

Enters Polyethylene Yarn Field

► U. S. Rubber Co., New York, N. Y., has announced plans to enter the polyethylene yarn business as a producer and seller. The new yarn will be produced at Providence, R. I., in a plant of the company's Footwear and General Products Division. The Textile Division will be responsible for sales, with sales headquarters located at 1230 Avenue of the Americas, New York, N. Y. The company decided to enter the polyethylene yarn business because market research studies have indicated that this business has tremendous growth potential and that there will be room for another manufacturer of top quality polyethylene yarns. According to U. S. Rubber, a combination of low cost, high tensile strength, excellent chemical resistance, good heat resistance and resistance to rot and water absorption has made polyethylene yarn attractive to manufacturers of many products.

Named General Tire Representative

► Glenn C. Vickery has been appointed chemical sales representative for the General Tire & Rubber Co., Akron, Ohio, with headquarters in New York City. He will cover the Middle Atlantic States. A native of New Hampshire, Mr. Vickery holds a bachelor of science degree in chemical engineering. He is a member of the American Chemical Society and Alpha Chi Sigma fraternity. Before he joined General Tire, Mr. Vickery was associated with the Stauffer Chemical Co. He has also been associated with the Baker Castor Oil Co.

Officers and Advisory Group Named

► B. F. Ilsley, general manager of the Wire and Cable Department for the General Electric Co., has been re-elected chairman of the Wire and Cable Section of the National Electrical Manufacturers Association. The Section also re-elected vice-chairmen David E. Allen (Anaconda Wire and Cable) and H. B. Bassett (Acme Wire). In addition, the following were elected to the Advisory Committee: R. C. Bennett, Jr. (National Electric Products); H. T. Brinton (Phelps Dodge Copper Products); H. W. Clough (Belden Manufacturing); A. D. R. Fraser (Rome Cable); V. W. Heimberger (U. S. Steel); C. W. Higbee (Kaiser Aluminum and Chemical Sales); J. R. MacDonald (General Cable); A. F. Metz (Okonite); Everett Morss (Simplex Wire and Cable); Samuel A. Rea (Rea Magnet Wire); A. F. Sheldon (Kennecott Wire and Cable); William E. Sprackling (Anaconda Wire and Cable); S. E. Yeaton (John A. Roebling's Sons).

Boston Elects Officers

► Officers for 1958 were elected at the Annual Christmas Party of the Boston Rubber Group, which was held on December 13 at the Somerset Hotel, Boston, Mass. Newly elected officers are: *Chairman,* Roger L. Steller (B. F. Goodrich Chemical); *Vice-Chairman,* William H. King (Acushnet Process); *Secretary-Treasurer,* James J. Breen (Barrett & Breen). The *Executive Committee* for 1958 will consist of: George E. Herbert (Tyer Rubber); John M. Hussey (Goodyear-Chemical); Arthur I. Ross (American Biltrite); Thomas C. Edwards (Acushnet Process). Harry A. Atwater (Malrex Chemical) is permanent historian. The Christmas Party included a cocktail hour, dinner, a floorshow and the distribution of door prizes. It was attended by 645 members.

Fort Wayne Hears Newton

► The Fort Wayne Rubber and Plastics Group held its second meeting of the 1957-58 season on December 5, 1957 at the Hotel Van Orman in Fort Wayne, Ind. Approximately 245 members and guests were in attendance. Ed Newton, of the Research Department of the B. F. Goodrich Chemical Co., gave a lecture entitled "Synthetic Natural Rubber", using slides to illustrate his talk. He discussed polyisoprene structures and test mileage projects. The next meeting has been scheduled for Thursday, February 13, 1958, and will also be held at the Van Orman.

New York Holds Xmas Party

► Approximately 600 members and guests of the New York Rubber Group attended the Annual Christmas Party held at the Latin Quarter in New York City. The meeting featured an excellent dinner and the presentation of a program of entertainment headed by "Mr. Television," Milton Berle. A number of valuable door prizes were distributed.

Reenters Housewares Field

► Sun Rubber Co., Barberton, Ohio, manufacturer of dolls and other toys, will reenter the housewares field in 1958, producing a line of at least 12 rubber and plastic houseware items. W. Earle Henderson, formerly general manager of the Rubber Division, will head the sales staff, having over-all supervision of the eastern, central and western sales districts. Keith Scanlon, formerly in industrial design sales, has been transferred to the housewares staff and will head the central division. The "Sun-Ware" line will include semi-rigid drain board trays in pastel colors, flexible drain board mats, stove top mats, sink bottom mats, bath mats, shower mats and a line of other products such as plate scrapers, soap dishes, sink stoppers, bottle stoppers, clothes sprayers and insecticide dusters. The company will confine its new products to white and four colors. This move is the latest step in the company's diversification program.

EIMA Holds Organizational Meeting

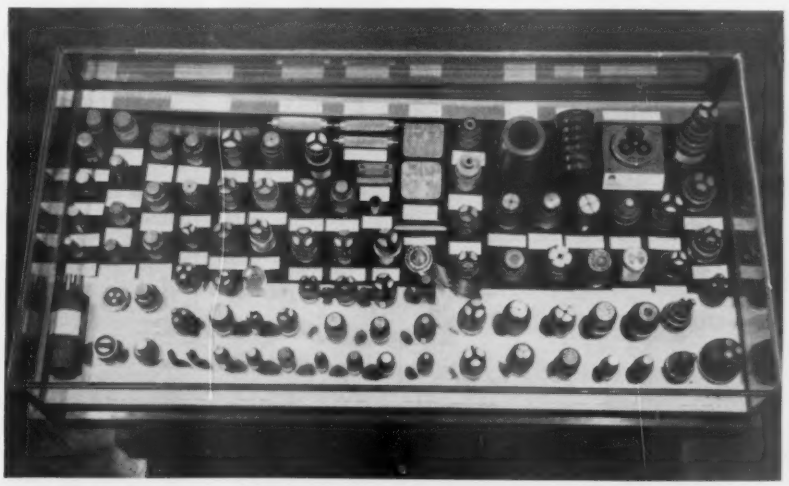
► At its organizational meeting held on December 10 and 11 in New York City, the Electrical Insulating Materials Association stressed the need for improving the flow of information on existing and new electrical insulating materials. The December 10 meeting was called by the working group of the proposed association and was attended by representatives of technical societies, trade associations and the working group. The December 11 meeting comprised representatives of manufacturers of electrical insulating materials. All present agreed that it was important that end users of electrical insulating materials be given more and better information on insulation than is now available. It was voted that the working group should continue its efforts and assist various technical societies and trade associations in carrying out the purpose of the new organization.

Union Carbide Executive Named

► D. B. Benedict, former president of Union Carbide Chemicals Co., has been elected a vice-president of the parent company, Union Carbide Corp., New York, N. Y. D. E. Fogle has been named to succeed Mr. Benedict as president of Union Carbide Chemicals Co., and H. D. Kinsey has been appointed president of the newly formed Union Carbide Olefins Co., also a division of the corporation. The Olefins company will handle the production and sale of ethylene, propylene, butadiene and other hydrocarbon products. Mr. Benedict joined Union Carbide in 1933 as a technical assistant in the South Charleston plant of the chemicals company. He was named vice-president in 1955 and president in 1956. Mr. Fogle became associated with Union Carbide in 1930 as a research fellow for the chemicals company at Mellon Institute. In 1954, he became vice-president. Mr. Kinsey has been with Union Carbide since 1924, when he joined the chemicals company as a cadet engineer in Clendenin, West Va., and he was appointed vice-president in 1954.

Organize New Department

► Illinois Industrial Rubber Co., Ladd, Ill., and its associate, Toledo Industrial Rubber Co., Toledo, Ohio, have organized a new department devoted to the development of new machines and methods for the production of long run, high precision molded mechanical goods. William B. Hullhorst has been appointed to head the department as chief engineer in charge of research and development at the Ladd, Ill., plant. Mr. Hullhorst has been active in engineering and management work in the rubber, plastic and glass industries in the Toledo area since before 1930. In 1949, he joined L.O.F. Glass Fibers, serving first as project engineer and then as plant manager of the Defiance, Ohio, plant. Later, he served the company as chief engineer.



► The hobby show sponsored by the Consolidated Edison Co. of New York in that city last October featured an historic exhibit of cable. Prepared by David Williams, manager of the Consolidated Edison Cable Bureau, the exhibit showed cable in use from 1881 through 1957.

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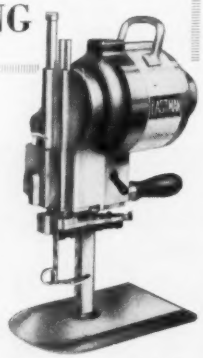

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Overseas

By Comtel-Reuter

Djakarta—Indonesia has placed all Dutch estates, agricultural enterprises and factories under government control, including undertakings jointly held by Dutch and Indonesian interests. The order was issued shortly after Indonesia had put military control over siezed Dutch banks in Djakarta.

Rotterdam—N. V. De Bataafsch Petroleum Maatschappij has decided to go ahead with plans for the construction of a general purpose synthetic rubber plant (butadiene-styrene type) at Pernis, which will have an initial capacity of at least 50 thousand tons a year. The decision to build the plant is based on studies of world rubber needs in the future.

Colombo—Ceylon may order tires and various other commodities from China to help the balance of payment position under the "rubber-rice" agreement between the two countries, which has left large balances in favor of Ceylon.

Kuala Lumpur—The Malayan government plans legislation to give pioneer industries "tax holidays" and other concessions. The Ministry said the government was aware that with a growing population, there could be a grave unemployment problem. The country is, therefore, encouraging light industries.

Tokyo—The Japanese Synthetic Rubber Co., a semi-official body, has been formally incorporated. The company is a joint enterprise of the Japanese government and the rubber manufacturing and petrochemical industries in Japan. Under the present plan, initial output for the first production year, 1959, will be 30,000 tons, made up of 27,000 tons of dry styrene rubber and 3,000 tons of latex. The company hopes to expand production to 45,000 tons annually.

Copenhagen—Tariff reductions totaling about five million crowns, have been proposed in the Lower House by the Minister of Finance. Proposed to help Danish export production to greater competiveness, the legislation will cover tractor tires among other goods.

London—A project to establish a tire factory in Spain has been halted after futile attempts to arrange the necessary finance required from Spanish sources, according to the Dunlop Rubber Company. The company attempted negotiations with the Sociedad Iberica de Gomas y Amientos SA of Bilbao and the Banco Popular Español Group.

Tokyo—The Japan Rubber Manufacturers' Association has provisionally set its production goal for rubber products in the 1959 calendar year at 150,000 tons, an increase of 8,000 tons over this year's estimated production. Manufacture of synthetic rubber products is expected to improve this year, especially that of synthetic rubber tire tubes for automobiles.

Kuala Lumpur—The National Union of Plantation Workers is to enter into negotiations with the Malayan Planting and Industrial Employers' Association for a new wage agreement for the country's 300,000 plantation workers. The union wants to stabilize wages, which at present change with the rubber market.

Ottawa—Canada's rubber footwear industry has asked the Tariff Board to recommend substantial tariff increases as protection against the growing imports of rubber footwear and rubber-soled canvas shoes from low wage countries. The recommendations are expected to be considered at public hearings of the board beginning March 12.

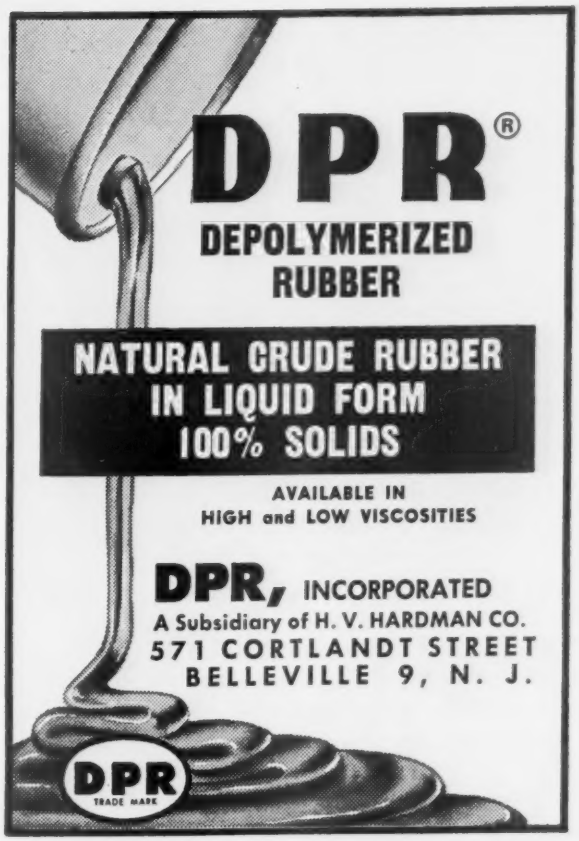
Kuala Lumpur — The rubber research cess, which finances research in natural rubber, will be increased to ¾c per pound starting February 6. This decision follows recommendations of the Blackman Committee. An official statement said that to execute the committee's recommendations quickly, adequate funds must be made available.

Perak—Local rubber tappers are trying to launch Malaya's first labor owned rubber company. Expected to cost 3 million Malayan dollars, the company will be called United Malayan Plantations, Ltd., and is expected to be registered at Ipoh later this month.

Colombo—Ceylon's House of Representatives has passed a bill to prevent the fragmentation of large tea and rubber estates into uneconomic holdings. The bill prohibits the subdivision and consequent fragmentation by sale, gift or partition among co-owners of tea and rubber estates which are at present over 100 acres. It provides for the establishment of a board to administer its provisions.

Paris—Fifteen foreign ministers of the Council of Europe have approved a British resolution concerning the creation of a European Free Trade Area. The resolution welcomed the decision of the 17-nation Organization for European Economic Cooperation to negotiate the establishment of the area.

Monrovia—A recent study of the Liberian economy indicates that approximately 6,000 acres were planted to high yield rubber in the 1957 season. Of an estimated 144,000 acres in rubber, about 40,000 are immature trees not yet in production.



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New Goods

StyleLiner One Piece Car Mat

► The "StyleLiner", a mat which permits continuous one piece coverage of front automobile floors, has been introduced by the Wooster Rubber Co., Wooster, Ohio. The StyleLiner was developed to protect the floor slope and transmission hump as well as carpeting underfoot.

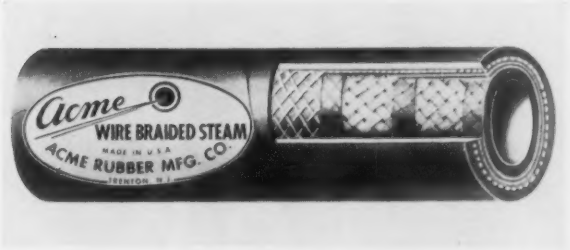
The company states that its heavy duty construction promises long, durable service and comfortable cushioning. The mat has a rib pattern which is said to be both attractive and easy to clean and a special underside pattern to hold it in place. The diamond shape motif, long a Kar-Rug identification, has been retained as decoration for the center portion which covers the transmission hump. The new mat will be available in blue, green, grey, red, white, brown and black.

Trapped Air Life Preserver

► Fabricators, Inc., Grantsville, West Va., and the U. S. Army Transportation Research and Engineering Command, Fort Eustis, Va., have jointly developed a new light weight life preserver for use by combat troops. Incorporating the trapped air principle, the preserver combines an air expandable collar assembly and a light weight fixed pad preserver. When the preserver falls into the water, hydrostatic pressure forces trapped air into the upper torso, providing support and buoyance. The body and head of the wearer are supported even if he has lost consciousness. The preserver, which is provided with a valve to release trapped air, can be rolled up into a pocket sized package weighing less than three pounds for storage and shipment. Weight and bulk of the fixed pad have been cut down by use of stays to assure retention of the required air volume within the pads. Compartmentation and use of light water-proof fabrics to encase the air cells offers insurance against puncture. The materials and components of the Trapped Air Life Preserver are said to be non-corrosive in salt water and non-flammable.

Acme W. B. Steam Hose

► The "Acme W. B. Steam Hose" has been developed by the Acme Rubber Manufacturing Co., Division of the Acme-Hamilton Manufacturing Corp., 115 Meade St., Trenton, N. J. Wire-braid reinforced, the new steam hose is said to be burst-proof and to be applicable for saturated steam service at pressures up to 200 psi, or for superheated steam up to 385°F. Reinforced construction prevents explosive rupture in case of hose failure



and a neoprene cover provides maximum resistance to heat, abrasion and petroleum products, the company states. The Acme W. B. steam hose is built around a tube compounded of special heat-resisting rubber for longer life under high-temperature live steam. Reinforcement is provided by one or two braided plies of high-tensile steel wire, each covered by a layer of heat resistant rubber. High-tensile cord yarn covers the outer layer and aids in bonding the neoprene hose cover. Standard sizes include ½, ¾, 1, 1¼, 1½, and 2½ inches ID.

Matador Recovery Kit

► Martin Co. has developed a recovery kit, consisting of parachutes and rubberized fabric air cushions, which permit reuse of the U. S. Air Force TM-76 Matador guided missile for training and test purposes. Previously a one-shot weapon, the Matador can be modified for reuse in the field by the replacement of its warhead section with the recovery kit. Specially adapted for the Matador by the Aviation Products Division of the Goodyear Tire & Rubber Co., the air cushions are inflated by compressed air. Diaphragms control the escape of air to prevent blowouts and sudden load shocks upon landing. The bags, which are made of neoprene coated nylon fabric, are highly stressed and high temperature resistant. They and the parachutes are reusable.

Fabrilite Coated Fabrics

► Canadian Industries, Ltd., Box 10, Montreal, Que., has added a new range of vinyl plastic coated fabrics to its line of "Fabrilite No. 1524" elastic furniture coverings. The new range, consisting of 12 colors in top grain embossing, provides bright finish in plain color. Three colors, shell white, coral and castle grey are new. Others available are honey white, off-white, blue ice, saffron, sunsand beige, emerald green, red, brown and black.

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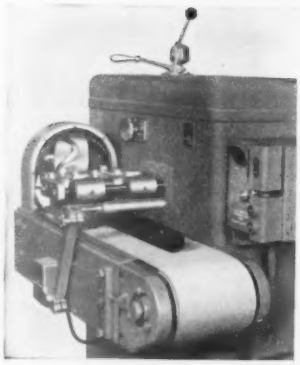

Tried-and-proven clutch designed and built by Fink for use on Wink cutters. Shown is Model M-420-A. Other models and special applications to fit individual requirements.

Let **WINK** Automate Your Molding Preparation and Cut Costs Radically

WINK cuts any extruded material, speeds being controlled automatically to equal extruding speeds; 3000 pieces per minute are possible. Right off the belt, WINK cuts lengths of 100 feet and more from 3" dia. down to thin 1/16" slices on 1/2" dia. stock; *no distortion or collapse.* Set-up time negligible; short runs practical. Waste reduced up to 90%.

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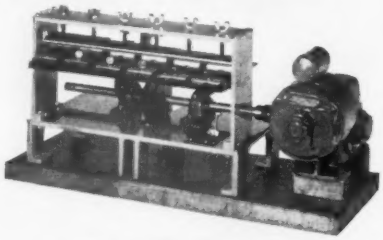
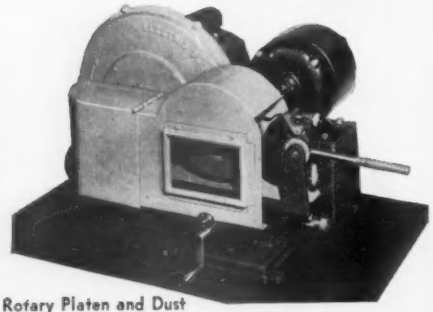
ROSS RUBBER FLEXING MACHINE (for ASTM D1052)





RUBBER SAMPLE BUFFING MACHINE

(Shown with Rotary Platen and Dust Collector with Suction Blower.)

EMERSON APPARATUS CO.
183 Tremont St., Melrose, Mass.

Vinalast Auto Seat Covers

► Marbek, Inc. of Brooklyn, N. Y., has introduced automobile seat covers made of Vinalast plastic coated fabrics. Utilizing Pliovic AO, the fabrics are said to be pliable, water repellent and to resist chipping, cracking

and peeling. A plastisol formulation based on Pliovic AO is used by Marbek to knife-coat osnaburg and drill fabrics. Use of the resin, the company says, requires lower and less critical fusion and gel temperatures, thus providing more efficient production operations. The coated fabric is manufactured in 25 colors and shades.

Uskon Type O Defrosting Blanket

► A flexible heating blanket for defrosting purposes has been developed by the U. S. Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y. Called "Uskon Type O", the blanket uses electrically conductive rubber for a heat source instead of hot wires. This results in flexibility which permits the blanket to be bent around corners without interference with even heating over the entire surface. The outer surface is compounded from vinyl plastic and Paracril oil-resistant synthetic rubber and is said to be highly resistant to oils and to be easily cleaned. Hermetically sealed, it may be operated when wet, or even under water, the company states.

The new blanket is said to be odor-free when hot and to have good service life expectancy when operated up to 250°F. Currently in commercial use, the blanket is expected to find wide use for home refrigerators and freezers. It operates on either 115 or 230 volts, and wattage can be varied to meet customer needs. Its maximum operating temperature, 250°F. can be reached in as little as three seconds or as long as 15 minutes. The blanket is thermostatically controlled. Thicknesses vary from 3/32nds to 5/32nds of an inch and weights, from 8 to 16 ounces a square foot. Stock blankets are grey in color and have a fabric-like finish. Other colors can be made on order.

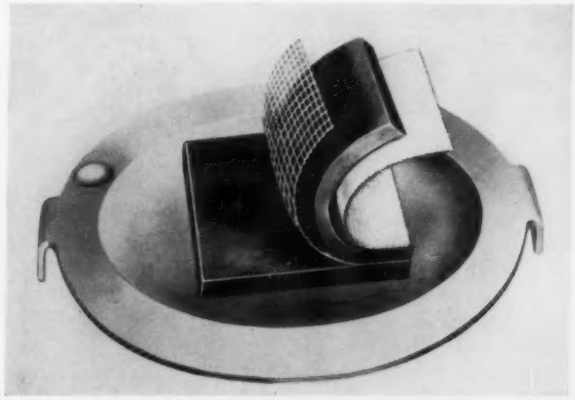
Firestone Free Fall Container

► Firestone Tire & Rubber Co., Akron, Ohio, has announced the manufacture of the "Free Fall Container", a saucer-like device to carry liquid food, fuel or water to stranded troops, hunters or explorers. The Free Fall Container, which is light and capable of withstanding terrific ground impact, may be carried by plane and dropped. The device is a development of Leslie V. Cooper, of the firm's Fuel Cell Division, who took a personal interest in the project after his son nearly lost his life on the Corregidor because of a water shortage.

At present, the new product is being tested by the U. S. Army Quartermaster Corps at Fort Devons, Mass., as a possible air-to-ground supply line. The current model, dubbed the "Flying Saucer", consists of solid rubber and has handles "clicked" into the saucer skirt. Two basic types have been produced for the Army. One has a petroleum-resistant rubber lining and is used for gasoline and other oil-base products. The other was designed for water or liquid foods. The water container weighs 55 pounds filled and the fuel container, 45 pounds. The container has satisfactorily withstood ground impacts from altitudes of 2,000 feet above the ground surface. A flap-like outer rim reduces velocity of the falling container. The latest Flying saucer model holds five gallons of liquid and measures 30 inches in diameter. It is six inches thick when filled.

Dill Tubeless Tire Patch

► Dill Manufacturing Co., 700 E. 82nd St., Cleveland 3, Ohio, has announced the development of a new nylon-reinforced patch for tubeless tire repairs, designated "No. 6626-25". The new patch is constructed with a square-



woven nylon mesh fabric sandwiched between two layers of what is said to be top quality uncured rubber. The company states that the nylon fabric reinforces the patch and prevents repairs from "blowing through" in cases of severe impacts or jolts to the tire. Twenty-five patches are packed in a box with one electric heating element. Extra filler rubber is also included.

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* AUTOMATIC CYCLE

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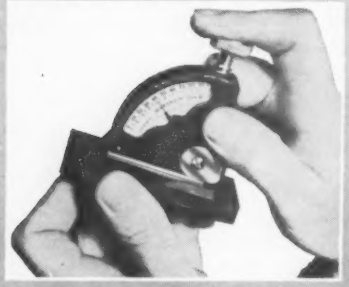

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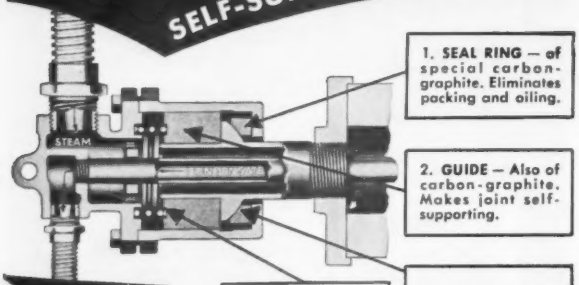
JOHNSON Rotary Pressure JOINT

SELF-SUPPORTING TYPE


STEAM
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2. GUIDE — Also of carbon-graphite. Makes joint self-supporting.
3. NIPPLE — Rotates with roll, seals against ring.
4. SPRING — For initial seating only. In operation joint is pressure sealed.

Only 4 Internal Parts

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Type SB shown handles both steam and condensate through same head; also available for through flow service, and in sizes and styles for all operating conditions. ***Write for literature.***

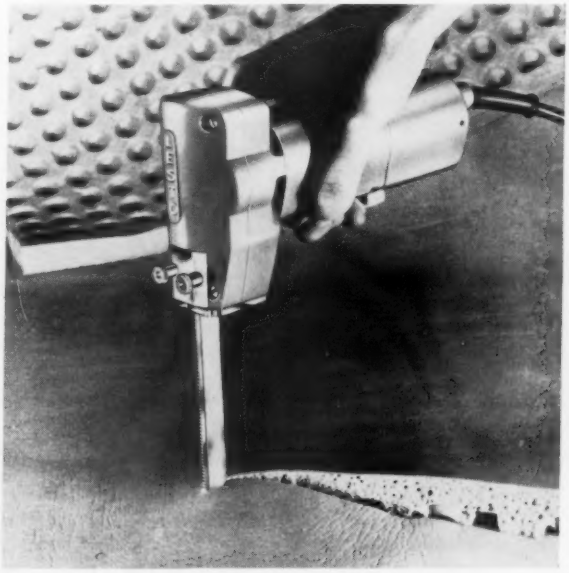
The Johnson Corporation

868 Wood St., Three Rivers, Mich.

New Equipment

Foam Rubber Saw

► An electric foam rubber cutter, the Lesto GEQ-2, has been developed by Scintilla Ltd., Solothurn, Switzerland for cutting of foam rubber and similar materials.



Sole distributor in the United States is Victor J. Krieg, Inc., 611 Broadway, New York 12, N. Y. The cutting is effected by two blades which saw in opposite directions. They are driven by a powerful universal electric motor, which operates on both direct and alternating current. Blades are available to cut foam rubber of 5¼, 8 and 11¾ inch thicknesses. The cutter, light in weight, is easily operated in one hand.

Tubular Infra-Red Radiant Heaters

► A new line of tubular infra-red radiant heaters for use in ambient temperatures up to 1000° F. is available from Douglas C. Whitaker Co., Inc., Glenside, Penna. The units can be used for baking, drying, curing, dehydration, degreasing, vulcanizing, preheating and other industrial applications requiring controlled heat. The line, which is called Vicoray, offers both panels and individual tubular elements completely wired and ready to be erected and connected for use. The units come in both 120 and 240 volt but can be wired in series for use with 480 volts if desired. The line ranges in wattages from 500 watts up to panels of 36 KW. Size ranges extend from 11 to 48 inches. The standard wave length is said to be suitable for most applications, but special units are also available. The heaters are guaranteed against "burnout" for one year.

Big Beulah Die Transfer Table

► A new die handling table manufactured by Hamilton Tool Co., Hamilton, Ohio, is designed to lift loads up to 2,500 pounds, transport them and slide them to another

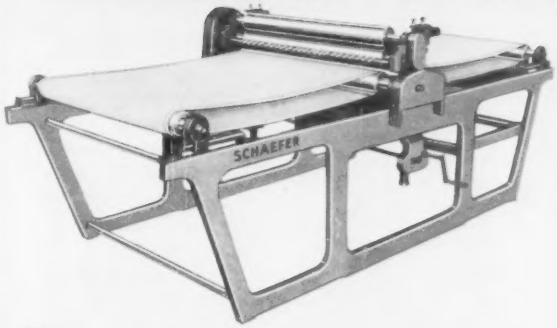
surface without manual strain. Called Big Beulah, the table can roll and turn, lift and lower, push and pull. The top plate is 22 x 34 inches, and is fitted with eight recessed free rolling conveyor rollers for ease in moving the dies or other loads. A ram, impelled by a screw-and-nut device, travels the length of the top plate, and is used to push loads from the table or to pull them onto the table.

Temperature Proportioning Control

► Temperatures are said to be maintained within a total spread of as little as one degree F. with a new and simplified proportioning control developed by Assembly Products, Inc., Chesterland, Ohio. The new control takes advantage of the positive action provided by the locking contacts of a meter relay, but is designed to level out the temperature to an extent never before possible with meter-relay on-off circuits. This improved design has been achieved by adding a condenser, a resistor and a 300-volt diode to one of the circuits used with the company's Simplytrol controls. The power supply voltage was increased from 125 to 300 volts.

Accuracy of the new control is achieved by use of an electrostatic attraction across the contacts of the meter-relay. This attraction is used both to proportion the amount of time the heat is turned on and to cause an anticipated, or premature, closure of the contacts before the limit point is reached, keeping the cumulative effect of a heat build-up from raising the temperature past the limit. Originally designed for the accurate control of temperatures from —200° to 3000° F., the circuit may be used to monitor other variables with comparable precision.

Schaefer Solvent RUBBER CEMENTER
for applying plastic & rubber cement



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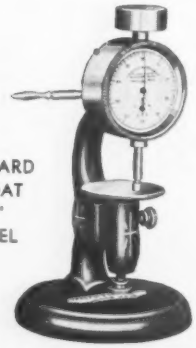

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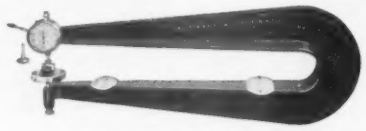
THROAT DEPTHS
1¾" to 26"
FOOT TENSIONS
supplied by Internal Spring or Direct Weights
FOOT DIAMETERS
⅛" to 1¼"
ROLLS
Table and Roll or two Rolls
RANGE
½" or 1", also 1 CM Metric



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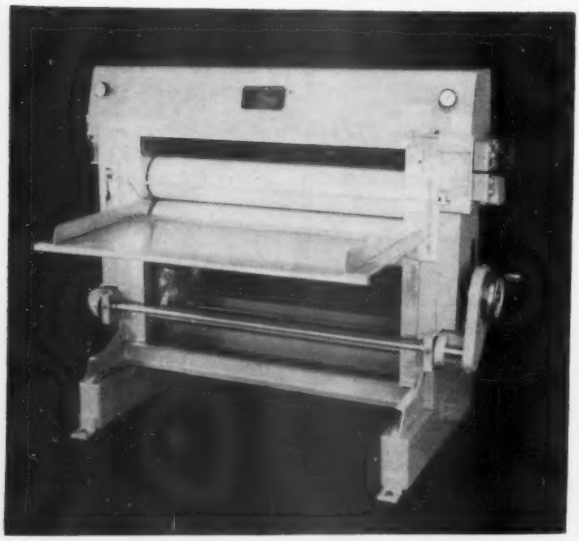

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Any Size **Any Type**

LEON MACHINE & ENGINEERING CO.
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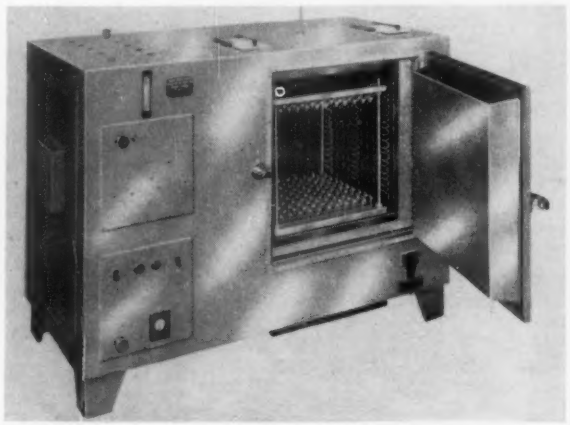
Special Industrial Machinery
For Urethane And Latex Foams

Blue M Convection Aging Oven

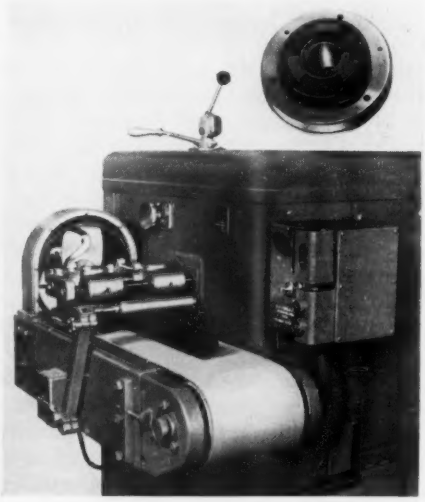
► The Blue M Con-Wate mechanical convention aging oven was designed specifically for certain ASTM tests involving accelerated aging at controlled temperatures



of rubber and other products. Featuring Power-O-Matic control, it is available with a temperature range to 180°C. The control is said to give fully automatic proportional wattage and to regulate temperature within ± ½°C. Manufactured in four standard sizes from one to ten cubic feet capacity, it comes ready for power hookup. The oven is a product of Blue M Electric Co., Blue Island, Ill.

Clutch for Wink Cutter

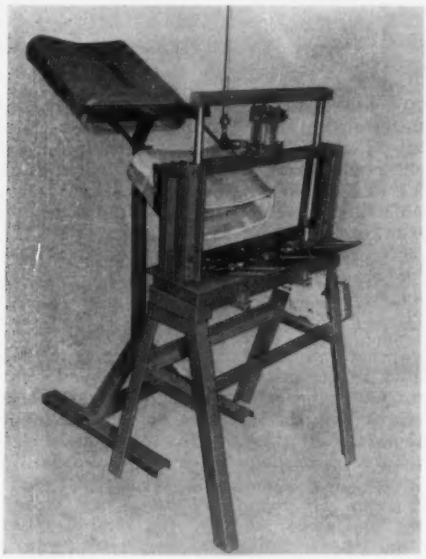
► The Wink Cutter for cutting rubber, plastics and other extruded materials is now equipped with a clutch



designed and built by the manufacturers, F. J. Fink & Co., 221 Cherry St., Chardon, Ohio. Conclusive tests are reported to have shown that the new high precision clutch makes possible higher speeds, cleaner and more accurate cutting, lowered maintenance, and longer life.

Gasket Spotting Machine

► The Armstrong Gasket Spotting Machine, manufactured by Armstrong Cork Co., Lancaster, Penna., was designed to solve the assembly line problem of gaskets slipping out of place or falling off before assembly is



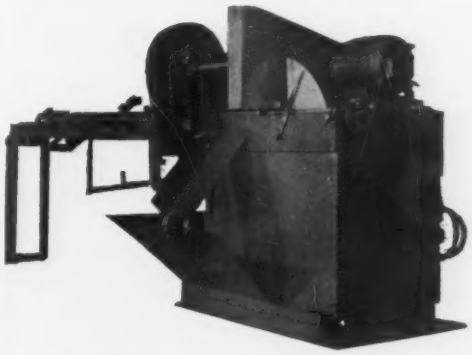
completed. The machine spots Armstrong T-922 hot melt adhesive onto the gaskets from a tank which heats the adhesive and keeps it at the right consistency. A gasket is placed on a bedplate on top of the tank and vertical studs on a hollow frame inside the tank are forced up through holes in the bedplate to place the adhesive at the desired spots on the gasket. The machine will accommodate different size gaskets. The tank holds about six gallons, enough adhesive for 20,000 to 30,000 gaskets.

► A **portable instrument for detecting and measuring static electricity charges** is available from United States Radium Corp., Morristown, N. J. Called the Statometer, it is designed for location and instant measurement of trouble spots in process flow, and to give immediate determination as to whether on not the disturbance is caused by static.

► A complete line of 6000 pound two- and three-way **control valves** for use on plastic molding and similar equipment, requiring extremely high operating pressures has been announced by Sinclair-Collins Valve Co., 454 Morgan Ave., Akron 11, Ohio. The valves feature bodies machined from solid aluminum bronze bar stock.

► The **Sure-Flex flexible coupling,** manufactured by T. B. Wood's Sons Co., Chambersburg, Penna., has two hub flanges and a two-piece rubber sleeve. All shock vibrations are reported to be absorbed by the sleeve. Elimination of rubbing and wearing surfaces is said to make lubrication unnecesary.

SLICER MACHINE
for
EXTRUDED STOCKS



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Length 3/16" to 8".
Cuts per minute 25 to 175.
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Made in three sizes.

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Reviews

BOOKS

Methoden der Organischen Chemie 'Houben-Weyl' (Methods of Organic Chemistry). (Fourth Edition). Edited by Eugene Müller in cooperation with O. Bayer, H. Meerwein and K. Zeigler. Published by Georg Thieme, Stuttgart, Germany. 20 volumes; average price $25.00 per volume; 7½ x 10½ in. (in German).

(EDITOR'S NOTE: An over-all review of 'Houben-Weyl' appeared in the March, 1957 issue of RUBBER AGE. Reviews of Volumes II; III, Part I; and VIII appeared in April, 1957, and of Volumes III, Part 2; IV, Part 2; VII, Part 1; and IX, in May 1957. Herewith is a review of the latest volume in the set. As additional volumes appear in print they will be reviewed in these columns.)

Volume XI, Part 1. 'Stickstoffverbindungen II.' By H. Glaser, F. Möller, G. Pieper, R. Schröter, G. Spielberger and H. Söll (Farbenfabriken Bayer AG., Leverkusen). 1224 pp. $49.50.

This volume deals with generally applicable methods for the synthesis of amines and contains in addition to proven published procedures numerous preparative methods and observations made in the laboratories of the authors, until now unpublished. Literature up to 1956 has been considered. The main chapters cover direct introduction of the amine group (14 pages); amines by substitution of halogens (85 pages),—of the hydroxyl group (128 pages),—of the carboxyl group, the nitro group, the sulfo group, the alkyl- and aryl-sulfonyl group, and other amino groups (amine exchange) (32 pages); amines by addition reactions (74 pages); amines by reduction (390 pages); amines by condensation (75 pages); amines through metal-organic compounds (22 pages); amines through rearrangement reactions (100 pages); amines through cleavage (69 pages); amines by special methods (11 pages); amines from other amines, maintaining the amino group (21 pages); preparative separation of primary, secondary and tertiary amines (8 pages); and properties and handling of ammonia (4 pages). An author index of 78 pages and a subject index of 62 pages conclude the volume.

This latest volume of 'Houben-Weyl' is, as the previous ones, an outstanding contribution to the chemical literature and of uncalculable value to preparative organic chemists. The methods presented have been selected to be operative, and the recommended methods, shown in the index with bold face type, are given in sufficient detail to be usable without the need of referring to the original literature. The discussions of the theoretical background of the reactions preceding the individual chapters of the book are lucid and well depicted by formulas and equations. Organic chemists working in the field of rubber chemistry will find this latest volume of 'Houben-Weyl' a valuable source of information since many accelerators used in the rubber industry are amines or their derivatives.

F. R.

•

Concise Guide to Plastics. By Herbert R. Simonds. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22, N. Y. 6 x 9 in. 318 pp. $6.95.

The title of this book was aptly chosen, as it provides a concise presentation of the most important characteristics of commercial plastics, covering such subjects as properties, uses, costs and sources. Data are given on strength and other physicals. Included is a list of the 43 most important companies which produce plastics, with their addresses, names of chief officers, company background and organization, products, trade names and descriptions of operations. Future trends and probabilities are also discussed, and the newest materials and production methods are described.

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BOOKLETS, CATALOGS, etc.

How to Plan and Install Your Own Conveying System. (Bulletin No. 500). A. B. Farquhar Division, Oliver Corp., 150 North Duke St., York, Penna. 8½ x 11 in. 20 pp.

This work-book offers a step-by-step guide to the selection, installation and operation of Farquhar conveyors. Typical conveyors are illustrated and described, and a chart of conveyor types and symbols shows such information as the best permanent and portable floor-to-floor installations for specific uses. Condensed specifications for establishing load requirements and conveyors that satisfy this factor are included. A detailed check list using a simplified question and answer format and graph paper for plotting the conveyor line enables the user to predetermine necessary facts. A closing section shows typical installations and gives the problem, solution, conveyor and accessories needed involved in each.

•

Cone-Drive Standard Gear Sets. (Bulletin No. CD-700-C). Cone-Drive Gears Division, Michigan Tool Co., 7171 East McNichols Road, Detroit 12, Mich. 8¾ x 11 in. 16 pp.

The Cone-Drive line of worm gearing, which is supplied in individually matched sets to provide high load-carrying capacity or small center distances, is detailed in this bulletin. Specification drawings for all worms and gears, as well as tool charts and horsepower ratings for hundreds of special gearset combinations, backlash tolerances, lubrication data and service factors are included. Tables present the necessary engineering data needed for ordering the worms, which are single or double extended shaft, and gears, which come in the hub, rim, flange, and shaft-mounted hollow bore types.

•

Allis-Chalmers Sodium Zeolite Water Softeners. (Bulletin No. 28-B-7107A). Allis-Chalmers Manufacturing Co., Milwaukee 1, Wisc. 8½ x 11 in. 6 pp.

This bulletin explains how Allis-Chalmers zeolite water softeners can be adapted to meet individual plant requirements of special water problems. Included is a description of the cycle of operation of the softener, as well as zeolite bed expansion and high capacity sodium zeolite resin rating curves. A table of capacity and specifications of the company's Series S and SA water softeners for processing industries requiring relative low soft water flow rates is also given.

•

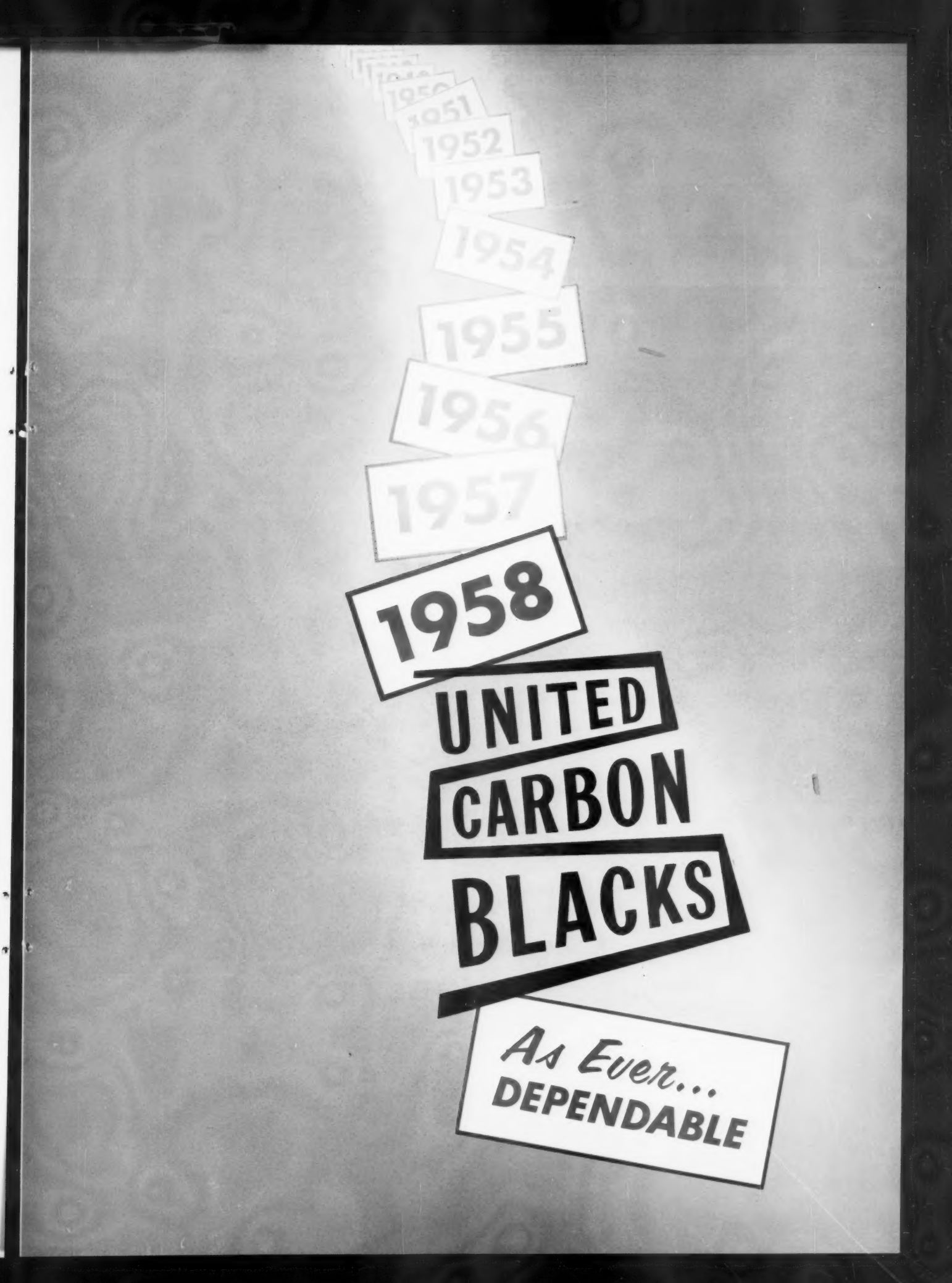
St. Joe Zinc Oxides. St. Joseph Lead Co., 250 Park Ave., New York 17, N. Y. 8½ x 11 in. 48 pp.

This booklet describes the production of St. Joe zinc oxides and provides a technical manual on their applications in the rubber and other industries. The technical data section covers the general properties of the zinc oxides and presents data on the physical characteristics of the various grades for different applications. The eight pages pertaining to rubber compounds deal with such subjects as activation, reinforcement, effects of trace elements and low heat generation. Tables, charts and photographs are used to amplify the text.

•

Peracetic Acid and Derivatives. (Booklet F-40, 108A). Union Carbide Chemicals Co., 30 East 42nd St., New York 17, N. Y. 8½ x 11 in. 48 pp.

This booklet includes a treatise on peracetic acid, reactions of epoxides and an extensive bibliography supporting these sections. It also lists properties and possible uses of twelve epoxides now available in research samples. Included in the latter are cross-linking agents, chemical intermediates and acid acceptors. Applications encompass specialty adhesives and epoxy resins with outstanding heat-distortion properties.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DuPont Elastomers and Chemicals. (Reference A-5737). Prepared by S. W. Schmitt. Elastomer Chemicals Department, E. I. du Pont de Neumours & Co., Inc., Wilmington 98, Delaware. 7 x 10 in. 76 pp.

This comprehensive booklet is divided into three sections: (1) Health Hazards; (2) Elastomers, with divisions on Hypalon and neoprene, and neoprene latex; (3) Chemicals, with divisions on accelerators, antioxidants, blowing agents, latex stabilizers, mold lubricants, peptizing and reclaiming agents, dispersed colors, special purpose chemicals and Hylene organic isocyanates. For each material physical properties, chemical composition and uses are detailed, and processing and vulcanization information is given if applicable. A list of literature references for each is also included.

•

Santocure, Santocure NS and Santocure MOR Accelerators for Rubber. (Technical Bulletin No. 11A/1). Monsanto Chemicals Limited, 10-18 Victoria St., London S.W. 1, England. 8 x 10 in. 32 pp.

Santocure accelerators are described in this booklet. General properties are analyzed, and processing and vulcanizing characteristics given for natural, styrene and nitrile rubbers. Also presented are data on variation of accelerator, variation of sulfur content, effect of secondary accelerators and of retarding agent. Use of the Santocure accelerators in natural rubber reclaim stocks is also discussed. Recipes are given for various stocks, including some useful for tire tread, mechanical molding, shoe soling and flooring compounds.

•

Mechanically Aided Thermal Processing with the Turba-Film Processor. (Catalog No. 117). Rodney Hunt Machine Co., Process Equipment Division, 117 Vale St., Orange, Mass. 8½ x 11 in. 24 pp.

The story of the Turba-Film Mark II Processor and how it utilizes the advantages of thin-film processing techniques is told in this catalog. The first section reviews the basic principles and techniques of thin-film processing, and includes flow sheets of the operation of the unit involving concentration, distillation, stripping and other applications. The second section makes a presentation of the machine and gives design, engineering and operating data. Typical uses of interest to the rubber and other industries are illustrated and described.

•

Paracril Nitrile Rubbers: Standard Grades Characteristics and Compounding. (Technical Bulletin No. 1—Revised). By W. E. Galwardy. Naugatuck Chemical Division, U. S. Rubber Co., Naugatuck, Conn. 8½ x 11 in. 32 pp.

This revised bulletin presents a thorough description of the Paracril nitrile rubbers. Opening with an introduction in which available commercial grades and their characteristic properties are detailed, the book continues with sections on the following: General Description, Processing, Basic Compounding, Compounding for Specific Properties, Paracril Cements, Recommended Uses. Much new information is included in this edition of the original Bulletin No. 1 on the same subject.

•

Naugapol K-50—High Styrene-SBR Masterbatch. (Bulletin No. 217). By I. E. Cutting. Naugatuck Chemical Division, U. S. Rubber Co., Naugatuck, Conn. 8½ x 11 in. 4 pp.

This publication is devoted to the Naugapol K-50 masterbatch. Sections deal with a general description of the materials and end uses, processing and compounding. A table gives data on how to vary the different ingredients, and formulas for oak sole and white floor tile, together with their physical properties, are included. A brief but informative presentation of the subject is made.

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Annotated Bibliography of Sources of Information on Rubber Compounding

(Continued from page 688)

R. T. Vanderbilt Co., New York, N. Y. *(Continued)*

"Building a Rubber Compound." 1946. Manual covering processing and compounding of natural rubber. With fundamental information and recommendations for factory compounds. A brief section also covers synthetic rubbers.

"Getting the Most Out of Vanderbilt Materials." 1938. Suggested recipes for fifty-nine different types of rubber goods.

"Getting the Most Out of Vanderbilt Materials." 1941. A series of booklets covering tires and tubes, footwear, proofing, mechanical goods, insulated wire and cables, etc., each having specific recipes for compounding rubber goods in its particular field.

"The Vanderbilt Rubber Handbook." Edited by S. S. Rogers, 9th Edition, 1948. A practical manual explaining basic principles of compounding and giving recommendations for specific types of goods, illustrated with numerous compound formulations and test data. Also includes a section describing frequently used physical test methods and a section of useful tables.

"The Vanderbilt Latex Handbook." Edited by G. G. Winspear, 1954. A practical manual on the handling and compounding of latex. Includes descriptions of latices and of compounding ingredients, compounding recommendations, both general and specific, descriptions of test methods, and a section of useful tables.

Wyandotte Chemicals Corp., Wyandotte, Mich.

"Handbook of Technical Information on Wyandotte Chemicals for Rubber." Looseleaf. Reports compounding studies using the company's calcium carbonates in natural and synthetic rubbers.

Abstracts

"Abstracts on Synthetic Rubber," compiled by M. Whalley, Ottawa, National Research Council of Canada, Parts I and II, 1943; Parts III and IV, 1946.

Mimeographed compilation of abstracts. Parts I and III cover articles and company releases; Parts II and IV, patents. Parts III and IV, covering the period 1943 and 1946, contain considerable material on compounding.

"Bibliography of Rubber Literature," M. E. Lerner, Editor-in-Chief, New York, Division of Rubber Chemistry, American Chemical Society (Years through 1939 compiled by D. E. Cable and published by **Rubber Age,** New York).

Very complete coverage of journals, patents and company releases. One-sentence abstracts, with references to more detailed abstracts where available, are arranged in systematic order by subject. Published at present only for years 1935 through 1951.

"Chemical Abstracts," Easton, Penna., American Chemical Society, published monthly.

Patents and articles from principal journals on rubber compounding are included. The abstracts are sufficiently complete to describe the contents of the papers.

"Resins-Rubbers-Plastics," edited by H. Mark, E. S. Proskauer and V. J. Frilette, New York, Interscience Publishers, published monthly.

Condensations of articles from foreign and domestic journals, including some articles on rubber compounding, published in looseleaf form for insertion in a binder according to subject. Abstracts include tables and figures from original references.

"Resins-Rubbers-Plastics Yearbook," edited by H. Mark, E. S. Proskauer and V. J. Frilette, New York, Interscience Publishers, published annually.

Compilation in bound form of the looseleaf abstracts cited above, each volume covering the year indicated. Includes subject and author index.

"Rubber Abstracts," Shawbury, Shrewsbury, Shropshire, England. Research Association of British Rubber Manufacturers, published monthly. (Formerly "Summary of Current Literature," published with "Journal of Rubber Research".)

Abstracts range from a few lines to half a column and include references to other abstracts. World-wide coverage of journals, patents and company releases. Annual subject, author and patent indices.

"The Rubber Formulary," Bakersfield, Calif. (P. O. Box 1568), published monthly.

Elastomer formulations with complete test data from domestic and British journals, and from releases of suppliers, recorded individually on marginally punched file cards. Published since 1948; approximately 1000 new cards per year.

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MARKET REPORTS

TRENDS
NEWS
PRICES

Natural Rubber

Since our last report (December 2), the price of spot rubber on the New York Commodity Exchange has moved in the range of 287 points, high for the period being 30.50c reached on December 9, and low being 27.63c reached on December 2. The average price of spot rubber for the month of December, 1957, was 29.25c based on 21 trading days. This compares with an average of 27.47c in the previous month.

According to reports from Europe, natural rubber is still holding its share of the market, despite the strengthening effects on its price because of Indonesian developments. The low price of natural late in November led European consumers to defer purchases of synthetic from the United States. Some American producers have noticed an appreciable decline in synthetic exports because of this situation.

Indonesian Disturbances

Even after a period of anti-Dutch moves in Indonesia, the price of natural still kept a full seven pence a pound below its level at the comparable period in the previous year. Traders are said to be stocking up with natural to avoid any shortages which may follow the cessation of supplies from Dutch-controlled plantations.

Rubber company officials in the United States do not seem to be too concerned about a disruption in the flow of natural rubber from Indonesia. They believe that over the long run, Indonesia will be compelled to maintain the export volume as rubber is that country's prime export. It is also felt that the Island of Sumatra, which turns out some two-thirds of Indonesia's rubber, has been maintaining a semi-independent status with regard to the national government.

A spokesman for Goodyear in Akron stated that the company had been unable to get a report from its plantations in Sumatra, apparently due to censorship, but company officials are assuming there has been no disruption of Goodyear's rubber producing and shipping operations.

While the Indonesian situation may still cause a great many difficulties, the world rubber trade has more or less settled down to await further developments. There is one point of view that is shared in most rubber circles and that is that Indonesian rubber production is bound to suffer without European management.

Stockpile Situation

The recently appointed Stockpile Advisory Committee is said to be polishing up the final draft of its special survey of critical and strategic stocks. There is no indication at this time whether the report will be made public. The Committee is concentrating on broad policy questions as related to the stockpile, including problems connected with the supplemental stockpile program.

The Committee will express its views on the role of the stockpile in event of nuclear war and will consider the entire problem of disposing of strategic stocks which might no longer be required in the stockpile.

NEW YORK, JANUARY 2, 1958

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM DECEMBER 1 TO DECEMBER 31

Dec.	Spot.	Jan.	Mar.	May	July	Sales
1	....	....	....	....	....	....
2	27.63	27.45	27.55	27.60	27.65	53
3	27.75	27.62	27.75	27.85	27.85	51
4	28.13	28.10	28.20	28.25	28.35	56
5	28.38	28.30	28.35	28.40	28.45	117
6	29.25	29.30	29.20	29.05	29.05	178
7	....	....	....	....	....	....
8	....	....	....	....	....	....
9	30.50	30.65	30.50	30.30	30.30	241
10	30.13	30.10	30.05	29.85	29.75	255
11	30.50	30.25	30.20	30.05	29.90	139
12	30.00	29.80	29.58	29.40	29.25	163
13	29.38	29.25	29.25	29.10	29.00	158
14	....	....	....	....	....	....
15	....	....	....	....	....	....
16	28.63	28.35	28.35	28.30	28.30	139
17	28.63	28.50	28.50	28.50	28.50	102
18	29.00	28.90	28.90	28.90	28.85	18
19	29.75	29.70	29.65	29.60	29.50	80
20	29.75	29.70	29.75	29.65	29.47	82
21	....	....	....	....	....	....
22	....	....	....	....	....	....
23	29.75	29.85	29.85	29.85	29.75	23
24	29.75	29.80	29.80	29.80	29.60	12
25	....	....	....	....	....	....
26	29.88	29.85	29.85	29.80	29.70	5
27	29.50	29.30	29.35	29.25	29.20	74
28	....	....	....	....	....	....
29	....	....	....	....	....	....
30	29.13	29.00	29.20	29.20	29.20	57
31	28.88	29.00	29.05	29.05	29.05	53

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.28⅝
Feb.	.28⅝
Mar.	.28⅝
Thin Latex Crepe:	
Spot	.30¼
Thin Brown Crepe, No. 2	.26⅜
Flat Bark Crepe	.21½

London Market
(Standard Smoked Sheets)

Mar.	28.40 - 28.69
Apr.-June	28.84 - 28.98

Singapore Market
(Standard Smoked Sheets)

Jan.	25.61 - 25.69

Middling Upland Quotations

	Dec. 2	January 2		
	Close	High	Low	Close
Mar.	36.21	35.79	35.75	35.75
May	36.18	35.98	35.90	35.92
July	36.04	35.87	35.75	35.78

Notes & Quotes

According to E. F. Tomlinson, president of the B. F. Goodrich Tire Co., tire industry sales in 1958 will approach the all-time high established in 1955. Mr. Tomlinson estimates that industry sales in 1958 will total 112,735,000 tires of all types, compared to 110,530,000 in 1957. The record year for the industry is 1955, when 114,244,000 tires were sold. Shipments of passenger car tires, including original equipment and replacements, are expected to total about 93,000,000 units in 1958. This compares with 91,050,000 in 1957. Mr. Tomlinson believes that replacement tire sales in 1958 will increase nearly 4 per cent over the estimated $1.5 billion sales in 1957.

Synthetic Rubber

According to current estimates, the United Kingdom and the rest of the Free World will consume some 385,000 long tons of synthetic rubber in 1958. Production of synthetic rubber in Canada and countries of the Free World is expected to total 210,000 long tons in 1958. This leaves a balance of 175,000 long tons which must be filled by the United States.

Should scheduled production plans by overseas plants be delayed for any reason, the deficit would have to be made up by imports from the United States. Canada, in 1958, is expected to produce 135,000 long tons of synthetic rubber. Germany should have two plants going during the year, one with a capacity of 10,000 long tons, the other with a capacity of 45,000 long tons.

It is expected that France will have a 20,000 ton unit in production sometime during 1958. Four plants in Great Britain are either in operation or will be in 1958. These include I.C.I.'s 20,000 long ton plant; International Rubber's 45,000 ton facility; Dunlop's 2,000 ton unit, and another 2,000 ton plant.

By 1960, Japan will be producing 30,000 tons of butadiene-styrene rubber a year, and this may be increased to 45,000 long tons a year. Reports from behind the Iron Curtain indicate that Rumania is planning a 50,000 ton a year plant based on refinery by-products.

Synthetic Share Growing

It is estimated that in the United States synthetic rubber's share of the market in 1957 amounted to 63.3 per cent of all the new rubber consumed. The use of synthetic rubber elsewhere in the world (outside the Soviet bloc) amounted to 23 per cent of the total. Most of the foreign requirements were met by the United States. It is estimated that U.S. exports in 1957 were somewhere beween 190,000 and 200,000 long tons.

The general tenor of the situation would seem to indicate a decided uptrend for synthetic rubber, not only in the United States, but abroad. The feeling persists that natural rubber production will not be able to meet all the demands which may be placed upon it by rising world consumption of new rubber.

U. S. Synthetic Capacity

Even if Free World capacity to produce synthetic rubber is not materially expanded during the next few years, the United States, with a capacity of 166,000,000 long tons, will be able to make up the world deficit.

With these factors in mind, the situation for the synthetic rubber producing industry of the United States would seem to be a happy one. Where once the industry had to fight a more or less psychological barrier against the use of synthetic, especially in Europe, the battle is apparently won. Europeans are showing a definite swing to synthetic usage and technology and economics will dictate its future use. Within the next five years the percentage increase of synthetic rubber in the Free World may show a startling increase, many believe.

CYANAMID RUBBER

Chem Lines

NO. 14 OF A SERIES Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

Pepton® 22 Plasticizer for Black Extended and Oil Extended SBR Masterbatches

Pepton 22 has been shown to be effective in oil-extended SBR. Since its effectiveness is not diminished in the presence of furnace blacks, the possibilities of its use as a plasticizer in the black masterbatches of oil-extended SBR looked promising. A series of Banbury mastication tests were undertaken with such a masterbatch represented by SBR 1801. Conditions were designed to give a dump temperature approximating that encountered in factory processing. The results shown below are averages of the values obtained by duplicate runs on each mixture:

	Midget Banbury Jacket at 314°F, Rotors at 212°F		
Comp. No. 119	M207	M208	M209
SBR-1801 (gm)	300	300	300
Pepton 22 (gm)	0	1.0	2.0
(% on SBR hydrocarbon)	(0)	(0.58)	(1.17)
Mastication time (min.)	10	10	10
Dump temperature	345°F	345°F	345°F
Mooney Viscosity after mastication ML-4 at 212°F	104+	75+	65+

The Mooney Viscosity values clearly show the plasticizing effect of Pepton 22.

Trouble is sometimes encountered in the factory when furnace black is mixed with oil-extended SBR in a tread stock formula. The stock has a tendency to crumble when dropped from the Banbury to the sheet-off mill. Further tests were therefore carried out to determine the value of Pepton 22 in this application. A direct mix, with the plasticizing operation accomplished in the early stages of the mix, was studied with conditions designed to give a dump temperature of 340-350°F. Results indicated that 0.5 to 1.0% of Pepton 22 *on the polymer* had a satisfactory plasticizing effect and eliminated the crumbling tendencies. The plasticizing action may be increased, if desired, by using higher ratios of Pepton 22.

Vacuum-Packed Bags Save 20% Storage Space

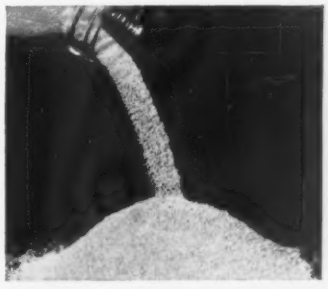
Vacuum packing is a recent service installed for the convenience of Cyanamid's MBTS customers. As these comparison photographs clearly show, this method of packing permits the use of a much smaller bag for the same weight of MBTS. Warehouse or storage space is reduced by as much as 20%.

MBTS Pellets

Comments frequently heard concerning the use of accelerators in powdered form are as follows:

The powder is too difficult to handle; it sticks to the scoop; it is dusty when poured; at times there is a definite material loss on weighing.

The fine texture of the powder may cause further material loss through Banbury venting systems or around loose packings. Increased costs and poor working conditions result.



Other rubber chemical manufacturers have made formed types of MBTS to eliminate these complaints. These formed materials have been moderately successful in overcoming the dust and handling problems of the powdered material. However, in most cases poor dispersion characteristics have offset the advantages gained by the use of the formed products.

Cyanamid's MBTS PELLETS are the answer to this challenge. The dustless form of the MBTS PELLETS eliminates handling problems and insures that there is no loss of material in weighing and use. The easy flow characteristics are noticeable from the above picture.

Laboratory tests and plant trial tests have indicated that Cyanamid's MBTS PELLETS have excellent dispersion characteristics and can be easily incorporated in the rubber stock during mill or Banbury mastication. Samples of Cyanamid's MBTS PELLETS can be obtained from your American Cyanamid Rubber Chemicals representative.

PRICES OF COMMERCIALLY AVAILABLE SYNTHETIC RUBBER POLYMERS

(dry types—per pound carload unless otherwise specified)

Butadiene-Acrylonitrile Types

Butaprene NAA	.5400	1
Butaprene NF	.4900	1
Butaprene NL	.5000	1
Butaprene NXM	.5800	1
Chemigum N1	.6400	3
Chemigum N3 and N5	.5800	3
Chemigum N6 and N7	.5000	3
Herecol N-33	.6800	2
Hycar 1001	.5800	3
Hycar 1002	.5000	3
Hycar 1014	.6000	3
Hycar 1041	.5800	3
Hycar 1042 and 1043	.5000	3
Hycar 1312	.5000	3
Hycar 1411	.6200	3
Hycar 1432	.5900	3
Hycar 1441	.6200	3
Paracril AJ	.4850	3
Paracril B	.5000	3
Paracril BJ	.5000	3
Paracril BLT	.5000	3
Paracril C	.5800	3
Paracril CV	.5900	3
Paracril D	.6500	3
Paracril 18-80	.6000	3
Polysar Krynac 800	.5000	3
Polysar Krynac 801	.5800	3
Polysar Krynac 802	.5000	3
Polysar Krynac 803	.5000	3

Butadiene-Styrene Types

Ameripol 1000	.2410	3
Ameripol 1001	.2410	3
Ameripol 1002	.2435	3
Ameripol 1006	.2410	3
Ameripol 1007	.2425	3
Ameripol 1009	.2475	3
Ameripol 1500	.2410	3
Ameripol 1501	.2410	3
Ameripol 1502	.2410	3
Ameripol 1703	.2060	3
Ameripol 1705	.2035	3
Ameripol 1707	.1910	3
Ameripol 1708	.1910	3
Ameripol 1710	.1885	3
Ameripol 1712	.1885	3
ASRC 1000	.2410	3
ASRC 1001	.2410	3
ASRC 1004	.2410	3
ASRC 1006	.2410	3
ASRC 1009	.2475	3
ASRC 1018	.2700	3
ASRC 1019	.2650	3
ASRC 1500	.2410	3
ASRC 1502	.2410	3
ASRC 1503	.2625	3
ASRC 1703	.2060	3
ASRC 1708	.1910	3
ASCR 3110	.2600	3
Baytown 1600	.1760	3
Baytown 1601	.1760	3
Baytown 1602	.1760	3
Baytown 1801	.1600	3
Copo 1500	.2410	3
Copo 1502	.2410	3
Copo 1505	.2610	3
Copo 1712	.1885	3
FR-S 1000	.2410	3
FR-S 1001	.2410	3

Butadiene-Styrene (Cont'd)

FR-S 1004	.2410	3
FR-S 1006	.2410	3
FR-S 1009	.2475	3
FR-S 1010	.2600	3
FR-S 1012	.2425	3
FR-S 1013	.2500	3
FR-S 1014	.2810	3
FR-S 1015	.2910	3
FR-S 1500	.2410	3
FR-S 1502	.2410	3
FR-S 1703	.2060	3
FR-S 1705	.2035	3
FR-S 1712	.1885	3
Naugapol 1016	.2650	3
Naugapol 1018	.2700	3
Naugapol 1019	.2650	3
Naugapol 1021	.3000	3
Naugapol 1022	.2800	3
Naugapol 1023	.2850	3
Naugapol 1503	.2625	3
Naugapol 1504	.2950	3
Philprene 1000	.2410	1
Philprene 1001	.2410	1
Philprene 1006	.2410	1
Philprene 1009	.2475	1
Philprene 1010	.2600	1
Philprene 1018	.2700	1
Philprene 1019	.2650	1
Philprene 1100	.1940	1
Philprene 1104	.1900	1
Philprene 1500	.2410	1
Philprene 1502	.2410	1
Philprene 1503	.2625	1
Philprene 1600	.1930	1
Philprene 1601	.1930	1
Philprene 1605	.1900	1
Philprene 1703	.2060	1
Philprene 1706	.2030	1
Philprene 1708	.1910	1
Philprene 1712	.1885	1
Philprene 1803	.1740	1
Plioflex 1006	.2410	3
Plioflex 1500	.2410	3
Plioflex 1502	.2410	3
Plioflex 1703	.2060	3
Plioflex 1710	.1885	3
Plioflex 1712	.1885	3
Plioflex 1773	.2060	3
Plioflex 1778	.1910	3
Polysar Kryflex 200	.2510	3
Polysar Krylene	.2410	3
Polysar Krylene NS	.2410	3
Polysar Krynol 651	.1885	3
Polysar Krynol 652	.1910	3
Polysar S	.2410	3
Polysar S-50	.2410	3
Polysar S-X 371	.2550	3
Polysar SS-250	.2875	3
S-1000	.2300	3
S-1001	.2300	3
S-1002	.2325	3
S-1006	.2300	3
S-1011	.2325	3
S-1013	.2300	3
S-1100	.1850	3
S-1500	.2300	3
S-1502	.2300	3
S-1600	.1825	3
S-1601	.1825	3
S-1602	.1825	3

Butadiene-Styrene (Cont'd)

S-1703	.1950	3
S-1706	.1925	3
S-1707	.1800	3
S-1709	.1775	3
S-1712	.1775	3
S-1801	.1675	3
S-1803	.1650	2
Synpol 1000	.2410	1
Synpol 1001	.2410	1
Synpol 1002	.2435	1
Synpol 1006	.2410	1
Synpol 1007	.2410	1
Synpol 1009	.2475	1
Synpol 1012	.2425	1
Synpol 1013	.2500	1
Synpol 1061	.2410	1
Synpol 1500	.2410	1
Synpol 1502	.2410	1
Synpol 1551	.2410	1
Synpol 1703	.2060	1
Synpol 1707	.1910	1
Synpol 1708	.1910	1
Synpol 1711	.1900	1
Synpol 1712	.1885	1

Butyl Rubbers

Enjay Butyl 035 and 150	.2300	2
Enjay Butyl 165 NS	.2400	3
Enjay Butyl 215	.2300	3
Enjay Butyl 217	.2300	3
Enjay Butyl 218	.2300	3
Enjay Butyl 268 NS	.2400	3
Enjay Butyl 325	.2300	3
Enjay Butyl 365 NS	.2400	3
Polysar Butyl 100	.2450	3
Polysar Butyl 101	.2175	2
Polysar Butyl 200 and 300	.2450	3
Polysar Butyl 301	.2550	3
Polysar Butyl 400	.2450	3

Neoprene

	(prices l.c.l.)	
Neoprene Types AC and CG	.5500	3
Neoprene Type GN	.4100	3
Neoprene Type GN-A	.4100	3
Neoprene Type GRT	.4200	3
Neoprene Type KNR	.7500	3
Neoprene Type S	.4200	3
Neoprene Type W	.3900	3
Neoprene Type WHV	.3900	3
Neoprene Type WRT	.4500	3
Neoprene Type WX	.4100	3

Silicone Rubbers*

	(prices l.c.l.)	
GE (compounded)	2.50	3
GE Silicone Gum (not compounded)	4.00	3
Silastic (compounded)	1.90	3
Silastic (gums)	3.85	3
Union Carbide (gums)	4.00	3
Union Carbide (compounds)	2.50	3

Polysulfide Rubbers

	(prices l.c.l.)	
Thiokol Type A	.4700	1
Thiokol Type FA	.6400	2
Thiokol PR-1	.9500	2
Thiokol Type ST	1.00	3

(latices—all prices per pound dry weight)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600	1
Butaprene N-400	.5400	1
Butaprene N-401	.5400	1
Chemigum 200	.4900	3
Chemigum 235	.5400	3
Chemigum 236	.5400	3
Chemigum 245	.4600	3
Chemigum 246	.4600	3
Hycar 1512	.4600	3
Hycar 1551	.5400	3
Hycar 1552	.4600	3
Hycar 1561	.5400	3
Hycar 1562	.4600	3
Hycar 1571	.5400	3
Hycar 1572	.5100	3
Hycar 1577	.4600	3
Hycar 1852	.4600	3

Butadiene-Styrene Types

Copo 2101	.3000	3
Copo 2102	.3200	3

Butadiene-Styrene (Cont'd)

Copo 2105	.3200	3
Copo X-765	.3000	3
FR-S 2000	.2775	3
FR-S 2001	.2775	3
FR-S 2002	.3000	3
FR-S 2003	.3050	3
FR-S 2004	.3050	3
FR-S 2006	.2900	3
FR-S 2105	.3200	3
Pliolite 2000	.2775	3
Pliolite 2076	.2900	3
Pliolite 2101	.2775	3
Pliolite 2104	.3200	3
Pliolite 2105	.3200	3
Pliolite 2107	.3250	3
Pliolite 2108	.3050	3
Naugatex 2000	.2630	3
Naugatex 2001	.2630	3
Naugatex 2002	.2880	3
Naugatex 2006	.2630	3
Naugatex 2105	.3120	3
Naugatex X-765	.2900	3
Naugatex X-767	.3120	3

Butadiene-Styrene (Cont'd)

S-2000	.2275	3
S-2006	.2150	3
S-2101	.2250	3
S-2105	.3100	3
S-2107	.3200	2

Neoprene

Neoprene Latex 60	.4000	3
Neoprene Latex 571	.3700	3
Neoprene Latex 572	.3900	3
Neoprene Latex 601-A	.4000	3
Neoprene Latex 735	.3800	3
Neoprene Latex 736	.3800	3
Neoprene Latex 842-A	.3700	3
Neoprene Latex 950	.4700	3

Polysulfide Rubbers

Thiokol Type MX	.7000	3
Thiokol Type WD-2	.9200	3
Thiokol Type WD-6	.7000	3

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.

MARKETS

(continued)

Reclaimed Rubber

It is now reported than some 270,000 long tons of reclaimed rubber were consumed in 1957, just about the same as in 1956, but considerably short of the several preceding years. Some in the industry are not too pleased with the ratio of reclaimed rubber use to new rubber use which has been declining for the past few years.

It is estimated that in 1957 the ratio use of reclaimed rubber to total new rubber was 18.3, while in the previous year it was 18.8. Expressing this in another way, in 1957, 15.5 per cent of all the rubber that was used was reclaimed rubber and in the preceding year the figure was 16.0 per cent. In 1952, 18 per cent of all the rubber used in the United States was reclaim.

The use of reclaimed rubber has apparently not kept pace with the consumption of new rubber. One reason advanced for this is price. In 1957, for example, prices for reclaim generally rose by about 5 per cent. Prices for synthetic rubber, were stable throughout the year.

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.11¼
First Line Whole Tire	.11
Second Line Whole Tire	.10½
Third Line Whole Tire	.10¼
Fourth Line Whole Tire	.09¾
Black Carcass	.15¼
No. 1 Light Colored Carcass	.22
No. 1 Peel	.11
Butyl Tube Reclaim	.14
Natural Rubber Black Tube	.16
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

The Scrap Rubber and Plastics Institute, NAWMD, reports that the scrap rubber market for 1957 was stable at a comparatively low level. Consumption of scrap by reclaimers averaged about 20,000 tons a month in 1957, while in 1956 about 22,000 tons a month were consumed. In general, the availability of scrap tires was greater than the demand.

It is reported that the entire scrap industry is undergoing a great change in methods of collection. Carload freight rates were increased by 7 per cent in 1957, and indications are that they may be further increased in 1958. This factor, plus steadily increasing labor costs, has made it uneconomical for many of the old accumulators to continue handling scrap.

The main suppliers of scrap tires today are said to be retreaders and recappers, who handle the scrap as a by-product. At this point, not too much hope is held for the scrap market in 1958 by many in the trade.

(Prices Delivered Akron)

Mixed tires	ton	15.50
Light colored carcass	lb.	.05
No. 1 peelings	ton	30.00
No. 2 peelings	ton	25.00
No. 3 peelings	ton	18.00
Buffings	ton	16.00
Truck and Bus S.A.G.	ton	19.00
Passenger S.A.G.	ton	17.50
Natural Rubber Red Tubes	lb.	.08
Natural Rubber Black Tubes	lb.	.07
Butyl Rubber Tubes	lb.	.04½

Tire Fabrics

According to Gerald S. Tompkins, president of the American Viscose Corp., rayon is making considerable progress in various industrial applications. During 1957, he stated, rayon found increasing use in such industrial applications as laminations involving paper, in rubber mechanical goods and in plastics.

Technological advances in rayon have made its use desirable for such industrial uses as ducks, tarps, belting and coated fabrics. Rayon's use in automobile carpeting in 1957 rose about 25 per cent, he reports.

George L. Storm, vice-president of the company, reports that 99 per cent of 1958 automobiles call for rayon cord tires as original equipment. He noted that the cord in these tires has about 40 per cent more strength than tire cord in use five years ago.

Industrial Textiles Firm

The trade reports that a modest pickup has developed in some wide industrial fabrics in recent weeks, although the pickup has not been as large as anticipated. Most of the buying of wide industrial fabrics has taken place in wide sheetings and drills. Plastic coaters and automobile manufacturers have been showing very little interest in broken twills or wide sateens.

Despite the modest volume of current trading, a firmer, more confident tone is evident in the market. This is partly attributed to the fact that clean and good quality cotton in required staple is due to become increasingly scarce. This, in turn, is expected to result in a tighter supply of good quality industrial fabrics.

To date, prices of wide industrial fabrics—like drills, sateens, broken twills and sheetings—have not advanced. The price hikes in many other cotton textiles, however, have served to trim wide fabrics. With just a little pick-up in demand, wide industrial fabric prices are likely to move up 1 to 2c a yard, trade sources believe.

Insulating Yarns Down

It is also reported that the demand for cotton insulating yarns continues spotty with very little interest shown for anything past immediate needs. Prices, however, have been holding fairly steady. Spinners catering to the insulating trade have not been particularly squeezed because they can use poorer grades of cotton which are in good supply.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.73
1650	lb.	.67
2200	lb.	.67½

Nylon Tire Cord

210	lb.	1.95
840	lb.	1.80

Rayon Graded Fabric

1100	lb.	.69
1650	lb.	.63½
2200	lb.	.63

Cotton Chafers

8.9 oz. (per square yard)	lb.	.68
9.25 oz. (per square yard)	lb.	.66
11.65 oz. (per square yard)	lb.	.62
14.4 oz. (per square yard)	lb.	.71

Liquid Latex

Consumption of all types of latex in the United States in 1957 is estimated to total slightly more than 160,000 long tons. This figure will represent an increase over the previous year's total of 156,000 long tons, and about 7,000 long tons less than the 167,000 long tons consumed in 1955.

Current figures indicate that in 1957 approximately 53 per cent of the latices consumed were synthetic, while 47 per cent were natural. Butadiene-styrene type latex, with about 67,000 long tons consumed, will establish a new high. Neoprene and nitrile latices, on the other hand, should just about match the 1956 figures as far as consumption is concerned.

There were no significant price changes for the synthetic latices during 1957, and this likely contributed to the consumption pattern. Natural rubber latex, on the other hand, ranged from 34c a pound to 44.75c a pound during the year. It is interesting to note that even when the natural latex was selling at the 34c a pound level, there was no appreciable increase in its consumption pattern.

Many in the trade believe that there is nothing on the horizon which would indicate any change in the consumption pattern for natural and synthetic rubber latices in 1958. It is expected that prices for the synthetic latices will remain stable, at least through the first quarter of the year, while the price for natural latex will retain its variable characteristics.

On the face of it, latex experienced a good year in 1957. What with rising consumption patterns in paints, adhesives, coatings and saturants, 1958 also bids to be a good year for the industry.

Cotton

The price of middling uplands on the New York Cotton Exchange has moved in a range of 65 points since our last report (December 2), high being 36.75c reached on December 11, 12 and 13, and low being 36.10c reached on December 2. The average price of middling uplands for the month of December was 36.50c based on 21 trading days. This compares with an average of 36.06c in the previous month.

The nearby positions in the cotton futures market eased considerably during the period, but for months marked time pending crystallization of sentiment in the new Congress regarding cotton legislation.

The parity price on December 15 moved upward to 37.43c and the significance of this trend is that the interim loan on cotton is based on the January 15th parity. Since the parity formula is based on a 10-year moving average, and upward revision in parity is expected, a higher loan for 1958 is possible.

Owing to a virtual government monopoly on the supply of cotton, and the government's regulations on both domestic and import trade, the volume of cotton futures traded in New York and New Orleans during 1957 totaled 21,700,000 bales compared with 29,900,000 in 1956, a decrease of 27 per cent. This is the fifth consecutive year of declining volume.

The Commodity Credit Corporation reports that loans on 1957 crop cotton through December 27 totaled 1,699,195 bales, and repossessions totaled 188,762 bales. Net stocks of 1,506,433 bales compared with 3,558,365 bales in 1956. It is expected that a higher loan in 1958 will cause greater repossessions from the 1957 loan stock.

STATISTICS of the industry

PERTINENT INDUSTRY DATA

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1931	501,788	355,200	25,609	322,000
1932	414,668	336,700	20,937	379,000
1933	418,902	412,400	20,576	365,000
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1953	647,150	553,473	8,376	112,316
1954	596,848	596,285	7,443	104,543
1955	635,174	634,800	10,611	110,105
1956	580,510	563,095	11,300	115,949
1956:				
Nov.	49,757	42,946	707	106,316
Dec.	57,653	45,227	912	115,949
1957:				
Jan.	46,349	52,631	691	101,758
Feb.	37,487	46,427	693	100,253
Mar.	40,680	48,263	1,218	97,820
Apr.	59,896	45,368	530	102,796
May	52,566	46,385	738	98,817
June	30,290	41,282	859	90,694
July	44,760	39,789	483	98,871
Aug.	48,951	44,846	1,000	98,782
Sept.	47,937	43,675	780	103,243
Oct.	44,466	48,782	926	102,496
Nov.	.....	48,782	....	97,754

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry: Long Tons	Dry: Declared Value	Latex: Long Tons	Latex: Declared Value	Total Imports
1936	467,064	152,072,496	19,852	6,659,899	486,916
1937	574,600	237,307,041	23,185	10,213,670	597,785
1938	397,640	125,373,864	11,944	4,168,127	409,584
1939	469,946	167,586,780	27,437	10,467,552	497,383
1940	781,202	303,308,823	33,789	14,593,466	814,991
1941	989,498	401,976,317	34,797	15,965,627	1,024,245
1942	266,276	112,537,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,223	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,223	75,511	46,353,333	647,146
1954	522,364	219,098,143	74,483	42,755,029	596,847
1955	542,507	360,435,303	92,825	80,163,114	635,332
1956	499,479	334,990,045	71,709	61,795,844	564,321
1956:					
Aug.	35,652	19,703,676	4,715	3,277,700	40,367
Sept.	40,184	23,453,972	2,790	2,207,011	42,974
Oct.	40,690	28,494,068	5,738	4,341,172	46,428
Nov.	44,995	26,695,282	4,761	3,698,504	49,756
Dec.	50,992	31,077,000	6,661	5,170,306	57,653
1957:					
Jan.	39,889	24,412,461	6,461	5,203,207	46,350
Feb.	33,145	21,603,218	4,342	3,491,712	37,487
Mar.	34,824	22,769,949	7,336	5,193,356	42,160
Apr.	51,084	31,631,505	8,812	6,608,083	59,896
May	46,772	26,960,166	5,794	4,309,057	52,566
June	25,481	15,262,392	4,810	3,605,798	30,291
July	38,517	23,567,902	6,243	4,721,139	44,760
Aug.	42,117	25,931,151	6,834	4,900,028	48,951

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Latin America	Rest of World*	Total*
1945	8,600*	10,000*	97,500	12,000*	47,125	73,570	250,000
1946	403,719	175,000*	94,000	19,975	39,678*	105,080	837,500
1947	646,362	277,951	89,000	38,128	34,928*	172,782	1,260,000
1948	698,189	432,349	95,000	43,935	29,158*	225,557	1,525,000
1949	671,503	432,996	89,500	43,010	27,318*	225,659	1,490,000
1950	694,090	696,472	113,500	48,482	26,902*	280,299	1,860,000
1951	605,346	814,406	105,000	52,136	29,777*	278,262	1,885,000
1952	584,238	750,494	96,500	63,134	35,475*	261,211	1,790,000
1953	574,390	692,164	98,610	74,545	35,318*	250,182	1,725,000
1954	584,435	738,670	93,935	78,024	26,833*	280,112	1,802,500
1955	639,128	733,786	93,830	80,172	6,000*	344,584	1,897,500
1956	568,550	686,667	95,389	89,072	22,457	336,015	1,857,000
1957:							
Mar.	47,029	65,740	5,733	3,562	3,438	39,498	165,000
Apr.	49,091	61,140	7,317	6,306	2,706	23,440	150,000
May	45,519	48,455	7,359	6,995	2,069	24,603	135,000
June	51,295	49,970	6,510	4,849	1,554	30,822	145,000
July	56,534	86,863	9,551	....	500	39,052	192,500
Aug.	56,235	74,194	11,040	....	500	33,031	175,000
Sept	52,923	59,519	9,234	....	500	35,334	157,500

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1944	710,783	86,977	34,310	132,500	160,690	1,125,000
1945	799,009	91,047	41,836	87,500	108,164	1,127,500
1946	1,039,296	126,770	39,196	145,000	115,804	1,467,500
1947	1,122,327	156,399	61,452	242,500	153,548	1,735,000
1948	1,069,404	196,286	62,121	392,000	182,379	1,902,500
1949	988,903	186,622	56,362	446,500	207,388	1,887,500
1950	1,258,557	222,425	68,695	448,500	287,055	2,285,000
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,338,309	211,453	73,394	521,000	343,606	2,500,000
1954	1,233,012	247,612	71,656	544,250	408,094	2,505,000
1955	1,529,699	266,804	84,528	630,000	464,250	2,980,000
1956	1,436,482	232,345	91,458	775,500	489,215	3,025,000
1957:						
Mar.	129,913	22,967	7,883	71,000	44,987	275,000
Apr.	121,723	17,533	7,596	74,000	125,648	272,500
May	126,753	19,341	8,319	65,000	113,087	267,500
June	111,738	22,745	7,626	74,000	38,891	255,000
July	108,833	18,246	6,426	65,500	50,995	250,000
Aug.	124,204	12,708	5,252	62,000	48,336	252,500
Sept.	120,928	24,449	7,131	60,250	44,742	257,500

Source: International Rubber Study Group. * Estimated.

Rim Production

	1952	1953	1954	1955	1956
Passenger Car	24,936,844	31,318,461	25,952,322	38,092,080	27,109,610
Truck & Bus	5,752,674	5,228,321	4,463,689	6,642,329	6,315,428
Agricultural	2,073,116	1,943,487	1,297,040	1,931,768	1,416,938
Earth Mover	31,791	24,685	21,536	38,859	88,812
Total	32,794,425	38,514,954	31,734,587	46,705,036	34,930,788

	1957 June	July	Aug.	Sept.	Oct.	Nov.
Passenger Car	2,181,799	1,991,321	2,349,616	1,600,648	1,929,954	2,333,288
Truck & Bus	400,345	413,057	395,313	385,062	322,661	350,177
Agricultural	106,479	98,547	72,373	71,393	90,504	79,302
Earth Mover	3,862	9,470	3,680	5,575	1,890	9,677
	2,692,485	2,512,395	2,820,982	2,062,668	2,345,009	2,772,384

Source: The Tire & Rim Association, Inc.

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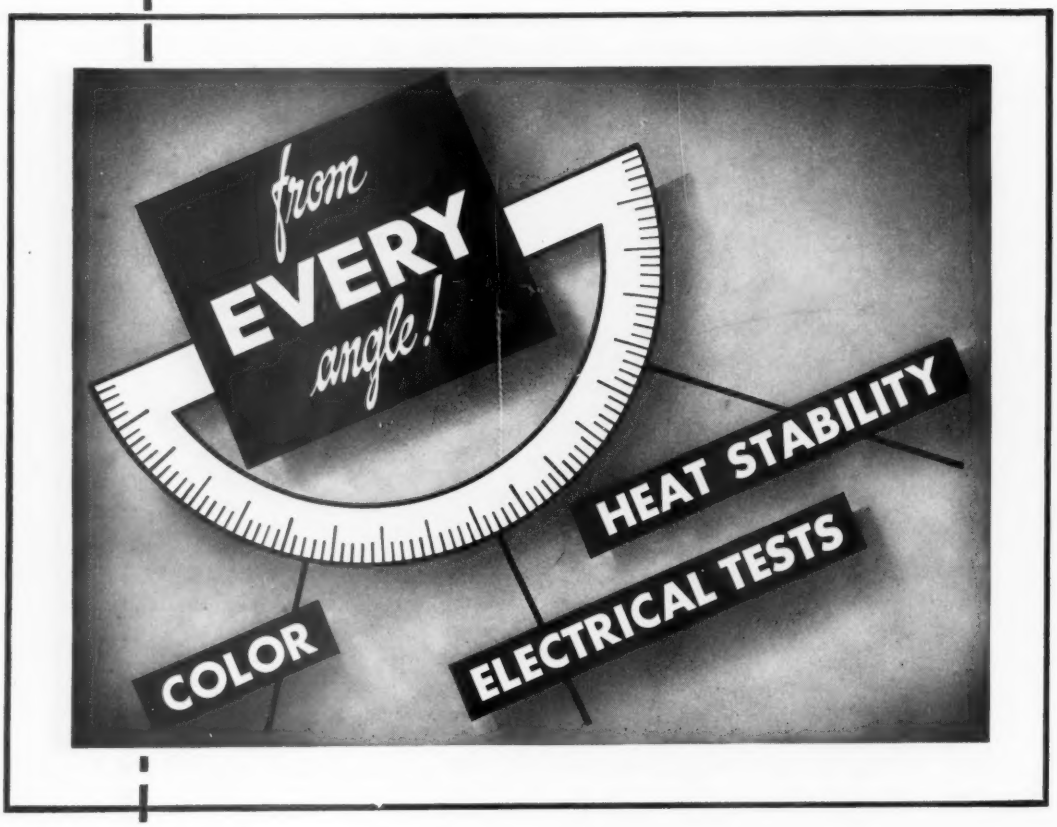

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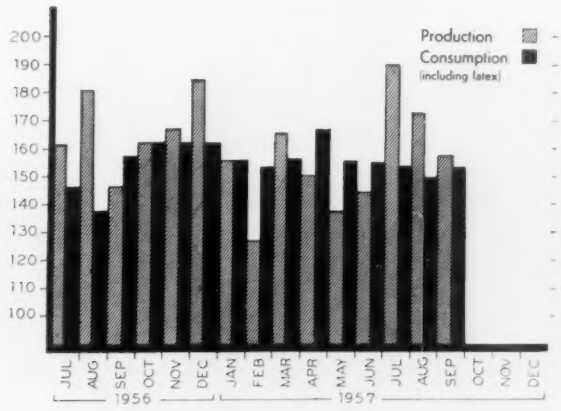
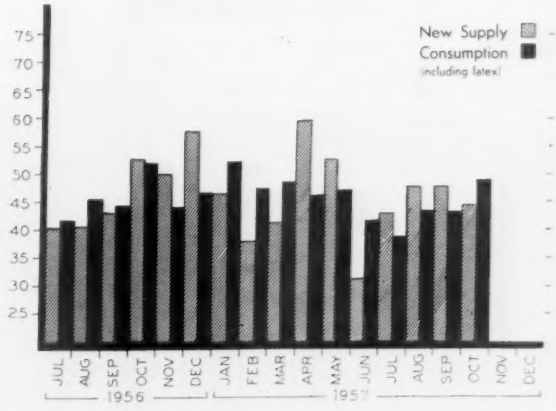
STATISTICS at a glance

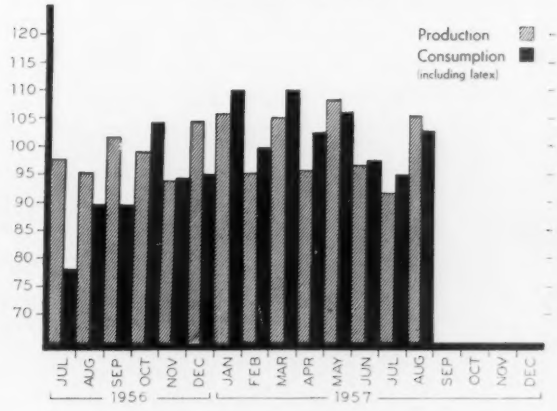
NATURAL RUBBER—WORLD
(thousands of long tons)



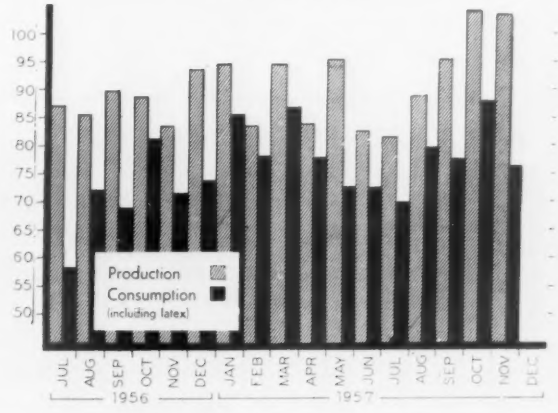
NATURAL RUBBER—UNITED STATES
(thousands of long tons)



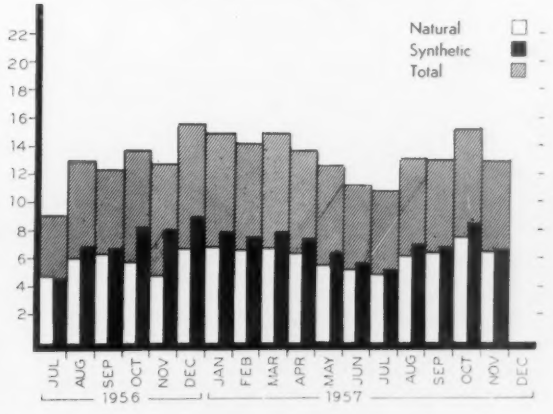
SYNTHETIC RUBBER—WORLD
(thousands of long tons)



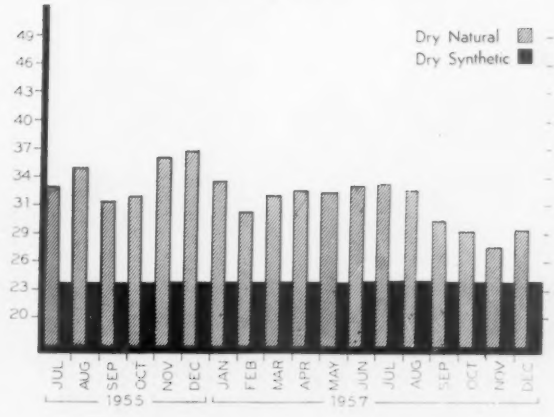
SYNTHETIC RUBBER—UNITED STATES
(thousands of long tons)



LATEX CONSUMPTION—UNITED STATES
(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC
(cents per pound)



Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1949	**310,539**	**35,215**	**54,046**	**11,072**	**410,932**
1950	**378,887**	**50,067**	**60,915**	**12,037**	**501,906**
1951	**704,529**	**58,907**	**76,475**	**15,333**	**855,244**
1952	**654,854**	**65,745**	**81,630**	**16,228**	**818,447**
1953	**680,728**	**80,495**	**79,801**	**20,198**	**861,222**
1954	**490,405**	**69,150**	**58,802**	**21,396**	**639,753**
1955	801,145	91,357	56,179	32,623	982,304
1956	876,982	99,412	75,873	34,547	1,086,814
1956:					
Dec.	76,056	8,828	6,447	2,881	94,212
1957:					
Jan.	76,224	9,432	6,366	2,957	94,999
Feb.	66,023	9,004	5,664	2,963	83,654
Mar.	76,546	8,031	6,460	3,320	94,357
Apr.	65,706	8,902	5,890	2,449	82,947
May	77,542	9,235	6,145	2,597	95,519
June	68,297	9,678	4,474	2,576	85,025
July	68,295	8,591	2,007	2,617	81,710
Aug.	76,585	4,033	5,479	2,773	88,870
Sept.	76,502	9,726	6,135	2,875	95,238
Oct.	87,709	9,545	6,085	3,062	106,401
Nov.	87,152	9,976	6,099	2,803	106,030

Consumption

1950	**416,230**	**43,781**	**66,348**	**11,930**	**538,289**
1951	**626,444**	**48,887**	**70,500**	**13,066**	**758,897**
1952	**666,420**	**55,522**	**71,229**	**13,866**	**807,037**
1953	**624,181**	**65,900**	**77,826**	**16,929**	**784,836**
1954	**500,345**	**57,203**	**61,464**	**17,715**	**636,727**
1955	741,997	72,876	53,991	26,035	894,899
1956	727,789	74,887	49,615	24,976	877,267
1956:					
Dec.	61,503	5,991	3,848	1,936	73,278
1957:					
Jan.	70,978	7,237	5,028	2,247	85,490
Feb.	64,322	6,235	4,581	2,122	77,260
Mar.	67,853	6,559	4,998	2,240	81,650
Apr.	63,280	6,295	4,651	2,129	76,355
May	66,774	6,441	4,902	2,125	80,242
June	58,479	5,816	4,198	1,963	70,456
July	58,021	5,231	4,146	1,646	69,044
Aug.	66,089	6,502	4,461	2,220	79,272
Sept.	64,505	6,351	4,654	2,141	77,651
Oct.	73,850	7,194	5,343	2,433	88,820
Nov.	62,484	6,194	4,518	2,074	75,270

Exports

1949	**1,401**	**3,330**	**178**	**1,574**	**6,483**
1950	**900**	**4,826**	**31**	**1,895**	**7,652**
1951	**483**	**6,825**	**216**	**1,725**	**9,249**
1952	**9,467**	**9,813**	**126**	**2,695**	**22,101**
1953	**7,692**	**11,494**	**237**	**3,245**	**22,668**
1954	**11,069**	**12,062**	**2,831**	**4,155**	**30,117**
1955	60,704	18,098	9,895	4,593	93,290
1956	112,366	21,909	8,699	6,194	149,168
1957:					
Jan.	13,989	2,500	207	540	17,236
Feb.	13,353	2,505	439	482	16,779
Mar.	13,664	2,466	1,014	781	17,925
Apr.	10,625	2,244	372	620	13,861
May	12,208	2,480	603	517	15,808
June	13,886	2,315	762	492	17,455
July	14,444	3,426	1,169	631	19,670
Aug.	13,795	2,786	758	478	17,817
Sept.	11,625	1,964	540	396	14,525
Oct.	12,200	2,588	1,261	467	16,516

Stocks

1949	**77,731**	**4,654**	**12,224**	**3,433**	**98,042**
1950	**36,942**	**5,733**	**7,243**	**2,840**	**52,758**
1951	**105,271**	**8,379**	**12,481**	**3,821**	**129,912**
1952	**83,861**	**8,535**	**22,716**	**3,875**	**118,987**
1953	**135,153**	**11,480**	**24,866**	**4,346**	**175,845**
1954	**115,499**	**11,349**	**19,267**	**4,280**	**150,395**
1955	108,989	12,220	10,500	6,030	137,739
1956	151,763	14,077	28,744	7,934	202,518
1956:					
Dec.	151,763	14,077	28,744	7,934	202,518
1957:					
Jan.	143,177	13,073	29,810	7,664	193,724
Feb.	134,587	12,705	29,951	7,565	184,808
Mar.	131,255	11,949	30,814	7,795	181,813
Apr.	122,764	12,064	31,536	7,247	173,611
May	121,638	13,010	31,812	6,981	173,441
June	120,694	13,822	31,569	7,085	173,230
July	113,143	15,172	28,208	7,125	163,648
Aug.	111,962	14,603	28,339	6,784	161,688
Sept.	109,417	14,751	29,132	7,207	160,507
Oct.	113,382	15,181	29,008	7,134	164,705
Nov.	125,141	16,544	29,857	7,306	178,848

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1945	4,768	15,176	7,077	.....	22,253	27,021
1946	8,012	24,810	13,595	.....	38,405	46,417
1947	17,675	22,474	6,089	.....	28,563	46,238
1948	32,630	21,494	5,022	.....	26,516	59,146
1949	29,974	21,357	3,651	.....	25,008	54,982
1950	54,401	31,339	5,725	.....	37,064	91,465
1951	54,963	32,972	6,866	2,948	42,786	97,749
1952	48,228	42,273	7,598	4,164	54,035	102,263
1953	75,511	48,112	9,026	5,844	62,982	138,493
1954	74,483	48,379	8,214	6,866	63,459	137,942
1955	92,754	69,364	10,432	10,798	90,594	183,348
1956	72,013	69,720	10,642	10,650	91,012	163,025
1956:						
Oct.	5,738	6,122	908	1,183	8,213	13,951
Nov.	4,762	6,053	886	1,175	8,114	12,876
Dec.	6,661	7,101	967	1,012	9,080	15,741
1957:						
Jan.	6,460	7,270	905	960	9,135	15,595
Feb.	4,342	6,491	724	1,035	8,250	12,592
Mar.	5,856	7,268	924	1,127	9,319	15,175
Apr.	8,812	6,348	976	881	8,205	17,017
May	5,794	5,495	1,082	933	7,510	13,304
June	4,809	5,241	819	886	6,946	11,755
July	6,243	4,646	572	844	6,062	12,305
Aug.	6,834	6,816	874	608	8,298	15,132
Sept.	7,417	5,649	917	1,285	7,851	15,268
Oct.	5,917	6,876	885	1,133	8,894	14,811
Nov.	.....	6,515	1,021	994	8,530	8,530

Consumption[1]

1945	**3,886**	**14,500**	**6,800**	**....**	**21,300**	**25,186**
1946	**5,714**	**23,500**	**13,000**	**....**	**36,500**	**42,214**
1947	**13,909**	**22,500**	**6,500**	**....**	**29,000**	**42,909**
1948	**28,489**	**21,500**	**5,250**	**....**	**26,750**	**55,239**
1949	**36,117**	**21,500**	**3,750**	**....**	**25,250**	**61,367**
1950	**56,138**	**31,000**	**5,500**	**....**	**36,500**	**92,638**
1951	**46,750**	**31,031**	**6,279**	**2,628**	**39,938**	**86,688**
1952	**53,567**	**40,562**	**7,368**	**3,093**	**51,023**	**104,590**
1953	**67,375**	**46,473**	**7,981**	**3,654**	**58,108**	**125,483**
1954	**75,931**	**44,173**	**7,251**	**4,507**	**55,931**	**131,862**
1955	86,478	63,982	8,736	8,495	81,213	167,691
1956	74,082	62,762	8,708	8,021	79,491	153,573
1956:						
Oct.	7,825	6,175	795	681	7,651	15,476
Nov.	6,431	5,406	723	659	6,788	13,219
Dec.	6,648	5,781	676	597	7,054	13,702
1957:						
Jan.	6,994	6,288	856	841	7,985	14,979
Feb.	6,398	5,894	758	708	7,360	13,758
Mar.	7,081	6,370	784	799	7,953	15,034
Apr.	6,434	5,554	772	710	7,036	13,470
May	5,867	5,114	814	731	6,659	12,526
June	5,445	4,790	736	610	6,136	11,581
July	5,180	4,269	677	480	5,426	10,606
Aug.	6,499	5,758	784	823	7,365	13,864
Sept.	6,645	5,676	712	753	7,141	13,786
Oct.	7,250	6,556	788	857	8,201	15,451
Nov.	6,735	5,661	735	599	6,995	13,730

Stocks at End of Period

1945	**3,121**	**....**	**....**	**....**	**....**	**3,121**
1946	**4,865**	**....**	**....**	**....**	**....**	**4,865**
1947	**5,033**	**....**	**....**	**....**	**....**	**5,033**
1948	**11,235**	**....**	**....**	**....**	**....**	**11,235**
1949	**5,063**	**....**	**....**	**....**	**....**	**5,063**
1950	**4,927**	**....**	**....**	**....**	**....**	**4,927**
1951	**4,752**	**3,727**	**1,245**	**532**	**5,504**	**10,256**
1952	**6,201**	**5,040**	**1,019**	**902**	**6,961**	**13,162**
1953	**13,532**	**4,794**	**1,117**	**721**	**6,632**	**20,164**
1954	**11,133**	**5,134**	**1,087**	**811**	**7,032**	**18,165**
1955	13,203	6,980	1,236	1,807	10,203	23,406
1956	12,064	7,451	1,384	1,558	10,393	22,457
1956:						
Oct.	12,322	5,703	1,263	1,680	8,646	20,968
Nov.	11,148	6,282	1,233	1,939	9,454	20,602
Dec.	12,064	7,451	1,384	1,558	10,393	22,457
1957:						
Jan.	11,831	7,191	1,329	1,936	10,456	22,287
Feb.	9,940	7,415	1,169	2,051	10,635	20,575
Mar.	10,173	7,689	1,170	2,157	11,016	21,189
Apr.	12,064	8,096	1,183	1,836	11,115	23,179
May	11,733	7,885	1,407	1,710	11,002	22,735
June	10,931	8,139	1,377	2,001	11,517	22,448
July	12,073	8,045	1,296	1,953	11,294	23,367
Aug.	13,535	7,997	1,309	1,545	10,851	24,386
Sept.	12,315	7,566	1,141	1,700	10,407	22,722
Oct.	12,399	7,254	1,042	1,723	10,019	22,418
Nov.	12,315	7,764	1,181	1,487	10,432	22,747

Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

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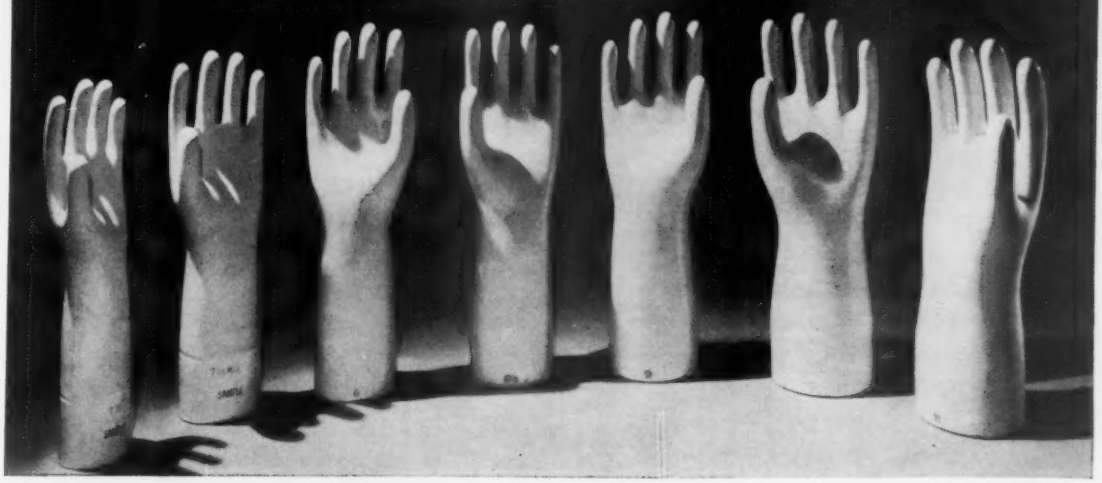

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Photo above shows curved finger HOUSEHOLD FORMS with oval base, 13½" long. Sizes range from 6 to 11, including half sizes. Finish—glaze, bisque, or "rough." Write for further information on forms of every kind.

TRENTON 8, NEW JERSEY

Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1956 Production Workers (thousands)	1956 Average Weekly Earnings	1956 Average Weekly Hours	1956 Average Hourly Earnings	1957 Production Workers (thousands)	1957 Average Weekly Earnings	1957 Average Weekly Hours	1957 Average Hourly Earnings
Jan.	229.5	$87.91	40.7	$2.16	216.0	91.21	40.9	2.23
Feb.	224.5	85.81	40.1	2.14	212.6	90.80	40.9	2.22
Mar.	220.8	84.93	39.5	2.15	211.4	89.28	40.4	2.21
Apr.	218.7	85.79	39.9	2.15	191.3	87.60	40.0	2.19
May	216.0	86.18	39.9	2.16	204.2	88.80	40.0	2.22
June	208.5	84.93	39.5	2.15	196.8	91.21	40.9	2.23
July	208.0	86.15	39.7	2.17	199.8	94.16	41.3	2.28
Aug.	210.8	87.64	40.2	2.18	204.3	92.84	40.9	2.27
Sept.	215.4	89.51	40.5	2.21	206.4	93.02	40.8	2.28
Oct.	220.0	90.17	40.8	2.21	207.2	....	...	...
Nov.	198.9	88.29	40.5	2.18	....	....	...	...
Dec.	221.5	93.15	41.1	2.25	....	....	...	...
Tires and Tubes								
Jan.	93.7	101.00	40.4	2.50	87.4	107.64	41.4	2.60
Feb.	93.2	97.71	39.4	2.48	86.8	106.19	41.0	2.59
Mar.	92.6	97.25	38.9	2.50	86.9	102.40	40.0	2.56
Apr.	91.8	98.00	39.2	2.50	71.1	103.46	40.1	2.58
May	91.6	99.65	39.7	2.51	84.9	103.46	40.1	2.58
June	90.1	98.25	39.3	2.50	78.2	107.23	41.4	2.59
July	90.0	98.14	39.1	2.51	83.9	112.20	42.5	2.64
Aug.	89.8	101.20	40.0	2.53	84.2	107.83	41.0	2.63
Sept.	91.6	102.51	40.2	2.55	84.5	107.33	40.5	2.65
Oct.	91.7	102.66	40.1	2.56	....	....	...	...
Nov.	74.8	103.53	40.6	2.55	....	....	...	...
Dec.	93.2	109.25	41.7	2.62	....	....	...	...
Rubber Footwear								
Jan.	21.0	74.37	40.2	1.85	18.3	71.76	39.0	1.84
Feb.	20.9	74.74	40.4	1.85	17.8	72.10	39.4	1.83
Mar.	20.7	71.34	39.2	1.82	17.8	72.68	39.5	1.84
Apr.	20.3	72.25	39.7	1.82	17.5	70.64	38.6	1.83
May	20.0	72.25	39.7	1.82	17.3	71.92	39.3	1.83
June	19.4	70.53	39.4	1.79	17.4	72.29	39.5	1.83
July	18.9	71.28	39.6	1.80	16.8	72.13	39.2	1.84
Aug.	19.2	70.35	39.3	1.79	17.2	73.05	39.7	1.84
Sept.	19.3	71.71	39.4	1.82	17.5	74.64	39.7	1.88
Oct.	91.1	71.71	39.4	1.82	....	....	...	...
Nov.	18.7	71.55	39.1	1.83	....	....	...	...
Dec.	18.4	73.26	39.6	1.85	....	....	...	...
All Other Rubber Products								
Jan.	114.8	79.73	41.1	1.94	110.3	81.39	40.9	1.99
Feb.	110.4	77.95	40.6	1.92	108.0	81.18	41.0	1.98
Mar.	107.5	76.99	40.1	1.92	106.7	81.19	40.8	1.99
Apr.	106.6	77.95	40.6	1.92	102.7	79.60	40.2	1.98
May	104.4	76.99	40.1	1.92	102.0	79.80	40.1	1.99
June	99.0	76.02	39.8	1.91	101.2	81.81	40.7	2.01
July	99.1	77.78	40.3	1.93	99.1	82.62	40.7	2.03
Aug.	101.8	78.76	40.6	1.94	102.9	83.84	41.1	2.04
Sept.	104.5	81.18	41.0	1.98	104.4	84.87	41.2	2.06
Oct.	109.2	82.98	41.7	1.99	....	....	...	...
Nov.	105.4	79.98	40.6	1.97	....	....	...	...
Dec.	109.9	82.59	41.5	1.99	....	....	...	...

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1954 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1950	1951	1952	1953	1954	1955	1956	1957
Jan.	31.89	45.04	42.96	33.24	34.15	35.07	35.24	34.82
Feb.	32.79	(a)	41.64	33.76	35.00	35.04	36.26	34.82
Mar.	32.65	46.06	41.70	34.10	35.23	34.33	36.70	35.35
Apr.	33.23	46.06	41.79	33.85	35.22	34.23	36.81	35.43
May	33.64	46.06	39.98	34.30	35.34	34.80	36.65	35.40
June	34.61	46.06	41.31	34.11	35.17	34.83	36.67	35.45
July	38.11	46.21	40.37	34.20	35.37	34.61	35.43	35.49
Aug.	38.93	35.93	40.42	33.82	35.19	34.53	34.31	35.15
Sept.	41.62	36.20	39.75	33.69	35.46	33.85	34.35	34.74
Oct.	40.66	38.13	37.52	33.53	35.24	33.93	34.45	35.09
Nov.	43.11	42.70	35.59	33.60	34.80	34.87	34.56	36.06
Dec.	43.37	43.32	33.76	33.52	35.03	34.95	34.56	36.50
Average for Year	37.05	42.43	39.71	33.81	35.10	34.59	35.50	35.36

Note: The Government established a ceiling of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1947-1949 = 100)

(Based on man-hours)

	1955	1956	1957		1955	1956	1957
Jan.	145	147	145	July	137	125	133
Feb.	144	140	145	Aug.	138	135	144
Mar.	146	135	142	Sept.	142	132	137
Apr.	147	136	131	Oct.	147	134	...
May	146	127	130	Nov.	147	126	...
June	149	120	129	Dec.	144	137	...

Sales by the Rubber Industry

(in Millions of Dollars*)

	1955	1956	1957		1955	1956	1957
Jan.	424	415	496	July	471	459	514
Feb.	440	445	495	Aug.	456	436	514
Mar.	466	451	476	Sept.	456	429	481
Apr.	445	445	490	Oct.	447	454	...
May	465	464	481	Nov.	482	463	...
June	465	450	458	Dec.	465	461	...

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1955	1956	1957		1955	1956	1957
Jan.	790	935	1,047	July	853	987	1,045
Feb.	782	970	1,036	Aug.	863	1,007	1,074
Mar.	805	979	1,030	Sept.	874	1,007	1,074
Apr.	784	970	1,031	Oct.	902	1,022	...
May	810	985	1,024	Nov.	935	1,024	...
June	850	975	1,027	Dec.	934	998	...

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1916	102	55	72.50	1937	26⅞	14	19.39
1917	90	52	72.23	1938	17 5/16	10⅛	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¼	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28⅜	13⅝	17.50	1943	22½	22½	22.50
1923	37⅛	24¾	29.45	1944	22½	22½	22.50
1924	40⅛	17⅜	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¼	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅞	24.21
1933	9⅞	2⅜	5.96	1954	34½	19½	23.61
1934	15⅞	8¾	12.92	1955	52	29⅜	39.16
1935	13¾	10½	12.37	1956	45	26½	34.24
1936	23	13½	16.41	1957	37⅜	26⅝	31.13

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1950	1951	1952	1953	1954	1955	1956	1957
Jan.	18.33	71.21	....	29.40	20.22	33.92	41.70	33.32
Feb.	19.40	73.61	....	27.57	19.98	34.90	33.68	30.43
Mar.	19.86	72.05	....	26.59	20.16	31.08	33.68	31.76
Apr.	23.51	....	....	24.66	22.06	31.75	31.74	32.23
May	28.07	....	....	25.52	21.96	31.35	29.61	32.12
June	30.92	....	....	24.42	23.01	34.74	30.54	32.80
July	39.10	....	30.52	23.64	24.12	40.84	33.91	32.88
Aug.	51.63	....	29.36	23.36	23.26	45.85	35.69	32.13
Sept.	55.98	....	27.42	23.06	23.99	48.27	32.64	29.94
Oct.	62.19	....	27.26	20.82	26.57	43.81	32.68	29.24
Nov.	73.05	....	29.25	20.58	28.07	44.95	35.18	27.47
Dec.	71.20	....	31.26	20.92	29.88	48.40	37.01	29.25
Average for Year	41.10	(*)	29.15	24.21	23.61	39.16	34.24	31.13

Note: (*) Free trading suspended March 31, 1951, and resumed on July 1, 1952.

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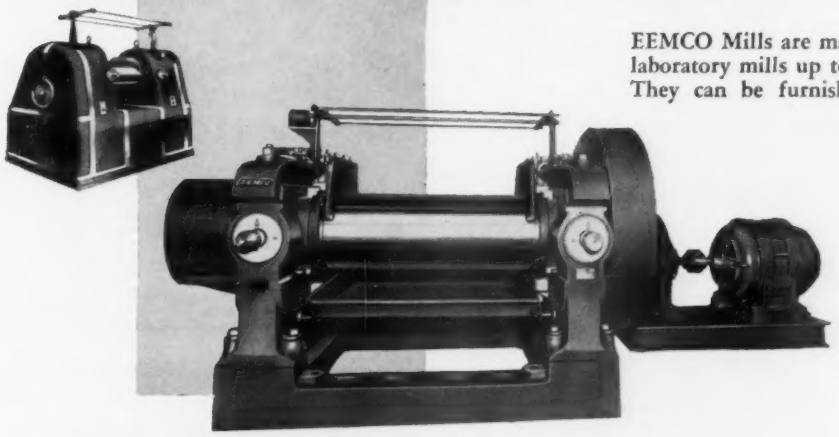

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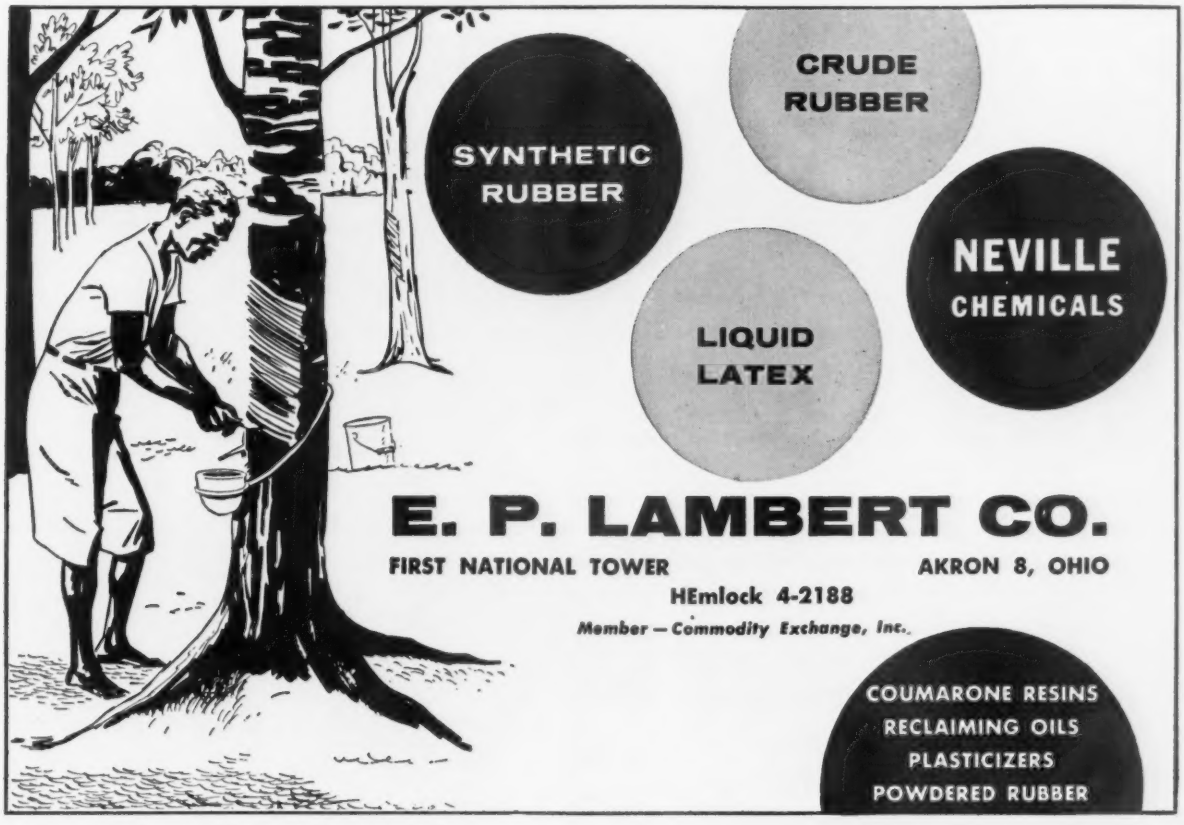

Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger Car	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger Car	33,106	45,798	809	79,713	81,455	13,044
Truck and Bus	4,843	9,326	734	14,904	14,696	2,676
1954 (total)	33,333	55,155	1,753	90,241	89,141	14,762
Passenger Car	29,741	47,044	928	77,713	76,794	12,217
Truck and Bus	3,591	8,111	826	12,528	12,347	2,545
1955 (total)	47,374	59,246	1,879	108,499	112,178	18,778
Passenger Car	42,574	50,189	966	93,730	97,223	15,963
Truck and Bus	4,800	9,057	912	14,769	14,955	2,815
1956 (total)	35,422	62,146	1,757	99,325	100,406	79,872
Passenger Car	30,873	53,252	875	85,000	85,546	16,494
Truck and Bus	4,548	8,894	883	14,325	14,859	3,378
1956:						
Sept. (total)	1,553	5,238	162	6,952	7,800	17,648
Passenger Car	1,261	4,427	70	5,758	6,647	14,468
Truck and Bus	291	811	92	1,194	1,153	3,180
Oct. (total)	2,908	4,703	165	7,776	8,799	18,775
Passenger Car	2,530	3,854	87	6,471	7,526	15,607
Truck and Bus	378	849	78	1,305	1,273	3,168
Nov. (total)	3,516	3,881	121	7,518	7,641	18,803
Passenger Car	3,179	3,255	62	6,496	6,580	15,596
Truck and Bus	337	626	59	1,022	1,060	3,207
Dec. (total)	3,579	3,803	166	7,548	8,556	19,872
Passenger Car	3,277	3,220	90	6,587	7,425	16,494
Truck and Bus	301	583	76	961	1,130	3,378
1957:						
Jan. (total)	3,496	5,195	183	8,874	9,504	20,490
Passenger Car	3,192	4,519	99	7,810	8,296	16,978
Truck and Bus	305	677	83	1,065	1,208	3,512
Feb. (total)	3,361	5,051	127	8,539	9,169	21,008
Passenger Car	3,017	4,453	68	7,538	8,047	17,376
Truck and Bus	344	598	59	1,001	1,122	3,633
Mar. (total)	3,381	5,579	154	9,114	9,766	21,743
Passenger Car	3,051	4,875	80	8,007	8,630	18,068
Truck and Bus	340	704	74	1,107	1,136	3,675
Apr. (total)	3,246	5,989	146	9,381	8,950	21,308
Passenger Car	2,809	5,218	78	8,104	7,878	17,821
Truck and Bus	438	770	69	1,277	1,072	3,486
May (total)	3,230	5,786	134	9,151	9,490	21,630
Passenger Car	2,831	5,166	60	8,057	8,312	18,050
Truck and Bus	399	620	74	1,094	1,178	3,580
June (total)	2,993	6,191	127	9,310	8,489	20,783
Passenger Car	2,623	5,476	63	8,162	7,462	17,322
Truck and Bus	370	715	64	1,148	1,027	3,461
July (total)	3,068	6,646	126	9,840	8,443	19,316
Passenger Car	2,719	5,826	65	8,611	7,449	16,097
Truck and Bus	349	819	61	1,229	994	3,219
Aug. (total)	3,214	6,488	130	9,833	8,917	18,477
Passenger Car	2,886	5,675	66	8,627	7,801	15,348
Truck and Bus	328	813	65	1,206	1,117	3,129
Sept. (total)	1,688	5,902	133	7,723	8,641	19,393
Passenger Car	1,398	5,096	70	6,564	7,535	16,310
Truck and Bus	290	805	63	1,159	1,105	3,083
Oct. (total)	2,620	5,351	182	8,154	9,708	20,985
Passenger Car	2,298	4,392	88	6,778	8,437	17,998
Truck and Bus	322	960	94	1,375	1,271	2,987

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1944	0	124,819	124,819	1954	5,558,897	1,038,045	6,596,942
1945	83,792	313,643	397,435	1955	7,920,186	1,245,018	9,165,204
1946	2,148,699	930,760	3,079,429	1956	5,816,109	1,100,417	6,916,526
1956:							
Jan.	591,032	98,968	690,000	July	440,980	80,731	521,711
Feb.	560,924	102,384	663,308	Aug.	417,020	85,827	502,847
Mar.	583,169	106,379	689,548	Sept.	203,888	71,299	275,187
Apr.	552,881	101,081	653,962	Oct.	352,140	92,684	444,824
May	474,010	96,114	570,124	Nov.	576,708	90,246	666,954
June	445,758	91,791	537,549	Dec.	617,599	82,913	700,512
1957:							
Jan.	628,045	91,117	719,162	July	484,718	94,924	579,642
Feb.	570,023	91,767	661,790	Aug.	521,282	89,150	610,432
Mar.	585,734	91,703	676,437	Sept.	318,279	62,087	380,366
Apr.	541,733	105,175	646,908	Oct.	291,064	88,019	379,083
May	537,112	102,312	639,424	Nov.	583,783	92,925	676,708
June	496,329	94,321	590,650	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	.....
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,957	36,072	878	74,907	74,425	11,874
1954	25,071	35,576	945	61,593	48,279	9,519
1955	5,001	33,387	1,001	39,389	35,900	6,833
1956	3,100	32,358	1,040	36,498	34,405	6,109
1957:						
Jan.	234	3,494	101	3,829	3,364	5,789
Feb.	267	2,964	61	3,291	3,362	5,960
Mar.	240	3,058	100	3,397	3,822	6,540
Apr.	311	2,708	85	3,104	3,428	6,969
May	301	2,829	84	3,214	3,548	7,422
June	275	3,128	69	3,472	3,025	6,946
July	258	3,364	86	3,708	2,941	6,287
Aug.	243	3,358	82	3,683	3,134	5,966
Sept.	213	3,180	90	3,483	3,365	6,174
Oct.	242	2,809	121	3,172	3,764	6,909

Source: The Rubber Manufacturers Association, Inc.

Vinyl and Vinyl Copolymer Resins—Sales

(Thousands of Pounds—Resin Content)

	Polyvinyl Chloride and Copolymer Resins							All Other Vinyl Resins		
	Film	Sheeting	Molding & Extrusion	Textile & Paper Treating	Flooring	Protective Coatings	All Other Uses	Adhesives	All Other Uses	Grand Total
1953	63,691	62,385	129,215	52,353	22,152	22,823	27,790	22,411	77,478	480,299
1954	69,943	56,588	147,284	49,546	34,890	23,676	35,148	26,609	74,090	517,773
1955	83,276	51,424	183,736	64,223	56,357	27,439	53,868	31,853	105,644	657,821
1956	78,063	55,598	206,726	62,931	65,384	28,522	71,859	36,565	115,151	720,799
1956:										
Sept.	7,159	4,194	17,228	5,198	5,526	2,025	5,945	2,893	9,291	59,458
Oct.	8,581	5,341	21,339	6,384	6,790	2,568	5,984	3,231	10,773	70,992
Nov.	7,002	4,774	19,895	5,888	6,253	2,639	6,128	3,115	10,242	65,936
Dec.	5,829	3,990	18,279	5,416	5,810	2,672	7,063	2,429	9,297	60,785
1957:										
Jan.	8,094	5,761	18,505	6,197	5,958	3,077	3,438	2,988	10,408	64,426
Feb.	8,669	4,564	19,805	5,137	6,221	2,682	3,258	3,255	9,529	63,120
Mar.	8,589	5,272	20,792	5,440	6,879	2,798	4,173	3,372	10,060	67,375
Apr.	7,036	4,191	18,393	4,616	7,890	3,495	4,254	4,211	8,975	63,061
May	7,641	3,765	18,218	4,628	7,519	3,227	4,388	3,404	10,371	63,161
June	7,098	3,861	17,195	4,688	6,245	2,362	3,791	4,467	9,851	59,558
July	6,342	4,362	14,340	5,371	6,030	2,755	2,872	3,236	7,976	53,284
Aug.	7,121	4,941	17,962	6,884	7,553	2,515	4,252	3,677	9,011	63,916
Sept.	9,406	4,987	18,653	6,542	7,156	2,363	4,189	3,191	8,771	65,258
Oct.	10,747	5,102	21,712	6,802	7,506	2,256	4,466	3,771	10,887	73,249

Source: Chemical Division, U. S. Tariff Commission.

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For further details regarding this and other Taylor-Stiles rubber cutters for rubber and plastics, write for illustrated, descriptive folder APP 202.

TAYLOR, STILES & CO.
216 Bridge Street
Riegelsville, N. J.

Various Compounding Materials Consumed by the Rubber Industry

Material	1949	1950	1951	1952	1953	1954	1955
Antimony, Primary:							
Short tons	55	103[c]	19[c]	66[c]	20[c]	49[c]	78
% of total	.005	.007	.001	.004	.001	.004	.006
Asphalt: [a]							
Short tons	18,050	26,819	21,414	33,288	.....	.....	.....
% of total	0.3	0.3	0.3	0.4	.....	.....	.....
Barite (Barytes):							
Short tons	14,000	19,000	15,000	18,000	21,000	20,000	25,104
% of total	2.53	3.31	2.13	2.0	2.0	2.0	2.0
Carbon Black:							
Short tons	383,565	515,184	530,614	537,273	566,797	511,813	643,430
% of total	93.3	92.9	93.9	93.1	94.4	93.5	93.5
Clay, Kaolin:							
Short tons	197,341	263,306	231,331	240,982	241,052	247,431	257,223
% of total	13.1	15.0	12.7	13.2	12.8	13.2	11.9
Clay, Fire & Stoneware:							
Short tons	27,148	9,500	.....	9,322	18,475	8,781	2,928
% of total	0.3	0.1	.....	0.1	.2	.1	.2
Lime:							
Short tons	715	908	1,126	2,000	1,631	1,555	1,465
% of total	.0002	.0002	[d]	[d]	[d]	[d]	[d]
Litharge:							
Short tons	1,398	3,047	2,641	2,109	2,230	1,768	1,947
% of total	1.2	1.7	1.7	1.5	1.4	1.3	1.3
Lithopone:							
Short tons	3,245	4,092	3,295	1,523	1,723	1,701	2,163
% of total	4.1	3.9	3.2	2.5	3.3	3.9	5.0
Mica, Ground:							
Short tons	3,856	5,776	6,551	5,126	5,668	5,021	7,339
% of total	7.0	8.0	9.0	7.0	7.8	6.3	6.9
Sulfur:							
Short tons	67,200	75,000	84,000	84,000	89,600	84,000	89,600
% of total	1.3	1.3	1.4	1.4	1.4	1.3	1.2
Talc: [b]							
Short tons	53,400	75,900	70,970	64,476	61,408	58,139	38,309
% of total	12.0	12.0	11.2	10.9	10.0	9.7	5.4
Zinc Oxide:							
Short tons	58,496	82,944	71,507	72,774	78,439	71,058	86,677
% of total	52.5	51.6	48.4	51.2	52.7	50.7	51.5

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	New Supply	Consumption: Tons	Consumption: % to Crude [a]	Exports	Stocks On Hand at End of Period
1941	**274,202**	**251,231**	**32.2**	**13,851**	**41,750**
1942	**286,007** [b]	**254,820**	**64.6**	**30,405**	**42,532**
1943	**304,058** [c]	**291,082**	**59.6**	**15,678**	**46,201**
1944	**260,631** [d]	**251,083**	**35.3**	**11,800**	**43,832**
1945	**243,309**	**241,036**	**30.2**	**13,413**	**28,155**
1946	**295,612**	**275,410**	**26.5**	**14,461**	**33,666**
1947	**291,395**	**288,395**	**24.8**	**14,556**	**35,943**
1948	**266,861**	**261,113**	**24.4**	**11,428**	**32,630**
1949	**224,029**	**226,679**	**22.5**	**10,637**	**28,263**
1950	**314,008**	**303,733**	**24.1**	**11,740**	**35,708**
1951	**366,700**	**346,121**	**26.6**	**14,722**	**45,082**
1952	**274,981**	**280,002**	**22.2**	**11,180**	**30,664**
1953	**298,336**	**285,050**	**21.3**	**11,597**	**32,319**
1954	**258,101**	**249,049**	**20.2**	**10,232**	**30,746**
1955	326,649	312,781	20.4	13,988	31,498
1956	287,220	270,547	18.8	13,832	34,969
1956:					
Nov.	20,009	20,832	18.2	1,189	36,063
Dec.	20,673	20,737	17.7	902	34,969
1957:					
Jan.	25,103	24,053	17.5	1,288	34,552
Feb.	21,896	22,773	18.4	1,263	32,010
Mar.	25,088	24,633	19.0	1,298	30,975
Apr.	22,878	23,145	19.0	1,201	30,258
May	24,884	23,816	18.8	1,277	29,847
June	22,402	21,352	19.1	1,083	30,379
July	20,469	19,676	18.1	757	29,972
Aug.	20,432	22,429	18.1	917	28,521
Sept.	19,892	21,704	17.9	714	25,983
Oct.	26,407	24,925	18.1	1,230	27,171
Nov.	22,031	20,432	17.2	.....	27,801

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics

(In Thousands of Pounds)

	Production: Rayon Tire Cord Not Woven	Production: Rayon Tire Cord Woven	Production: Cotton and Nylon Cord & Fabric [a]	Production: Chafer Fabrics (all fibers)	Production: Total Tire Cord and Fabric	Stocks [b]: Cotton and Nylon Cord & Fabric	Stocks [b]: Rayon Cord and Fabric
1956:							
Jan.-Mar.	23,707	74,833	29,298	14,176	129,199	10,185	48,936
Apr.-June	21,557	60,644	28,752	11,628	112,546	10,433	43,737
July-Sept.	18,698	56,961	26,349	7,958	102,575	11,094	44,376
Oct.-Dec.	20,071	55,655	28,493	9,497	104,921	12,500	38,060
Total	84,033	248,093	112,892	43,259	449,241	44,212	175,109
1957:							
Jan.-Mar.	21,853	68,825	31,393	11,028	123,182	11,844	37,153
Apr.-June	16,037	63,195	35,308	10,456	115,418	13,428	13,473
July-Sept.	10,509	54,968	33,432	9,102	100,046	13,305	36,388
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Combined to avoid disclosing figures for individual companies. (b) At end of period.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1951	1952	1953	1954	1955	1956	1957
Jan.	80,670	86,863	89,634	89,852	96,397	100,642	109,295
Feb.	72,864	82,043	86,458	86,206	88,464	98,088	96,694
Mar.	86,962	87,065	98,158	101,549	105,684	112,412	113,166
Apr.	87,573	98,563	102,044	103,866	111,116	113,034	115,820
May	100,266	101,137	105,918	104,418	115,707	123,560	124,325
June	96,364	99,305	114,703	113,037	120,710	126,838	121,598
July	100,567	105,307	112,969	112,231	115,653	120,708	130,251
Aug.	101,453	102,954	109,124	110,223	121,816	125,847	128,808
Sept.	91,891	100,095	106,158	104,706	113,379	111,574	113,567
Oct.	100,209	103,689	106,037	105,607	112,558	119,204	.....
Nov.	88,581	91,326	99,210	102,393	109,212	112,113	.....
Dec.	84,551	95,817	100,225	104,258	111,034	108,096	.....
Total	1,091,951	1,154,254	1,230,629	1,238,346	1,321,730	1,372,116	.....

Source: U. S. Bureau of Mines.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

Year	Balata: Tons	Balata: Value	Jelutong: Tons	Jelutong: Value	Gutta-Percha & Other Guttas: Tons	Gutta-Percha & Other Guttas: Value
1945	**1,361**	**907,253**	....	.....	**36**	**21,970**
1946	**2,281**	**2,233,065**	**304**	**256,169**	**423**	**458,064**
1947	**1,982**	**2,276,531**	**2,878**	**1,496,887**	**392**	**779,591**
1948	**1,195**	**805,078**	**3,401**	**2,377,765**	**423**	**542,788**
1949	**1,391**	**814,554**	**1,043**	**834,978**	**197**	**189,021**
1950	**2,117**	**1,589,885**	**1,789**	**1,515,162**	**541**	**745,418**
1951	**2,452**	**1,973,271**	**1,669**	**2,608,359**	**383**	**430,539**
1952	**988**	**762,994**	**1,636**	**2,094,983**	**282**	**385,890**
1953	**1,619**	**866,248**	**1,027**	**1,166,837**	**235**	**303,116**
1954	**949**	**504,065**	**2,196**	**2,624,926**	**417**	**511,055**
1955	1,022	967,369	1,679	1,731,821	284	318,115
1956	1,396	1,111,165	1,851	1,909,447	290	309,615
1956:						
Oct.	232	181,337	158	155,523	23	19,254
Nov.	232	194,511	116	144,945	74	45,853
Dec.	111	58,952	217	234,224	38	30,131
1957:						
Jan.	38	17,911	141	155,467	15	10,684
Feb.	12	12,191	117	130,001	22	27,792
Mar.	89	51,830	150	178,499	16	7,894
Apr.	167	100,490	134	160,369	28	23,714
May	201	116,150	192	225,257	69	87,987
June	36	17,426	130	134,438	22	35,112
July	33	15,195	161	185,524	28	32,282
Aug.	19	10,245	126	138,622	7	5,544

Source: U. S. Department of Commerce.

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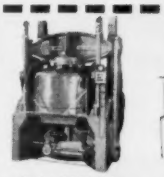
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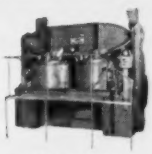
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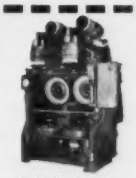
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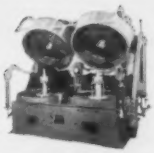
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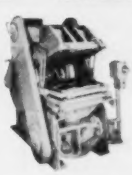
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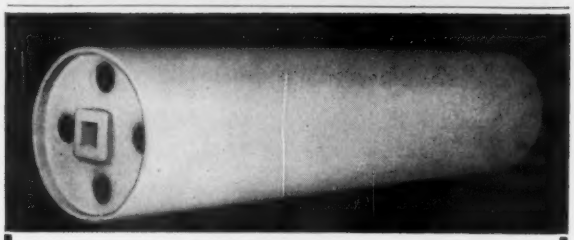

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